SCIENTIFIC AMERICAN

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SOME NOTABLE LOCOMOTIVES.

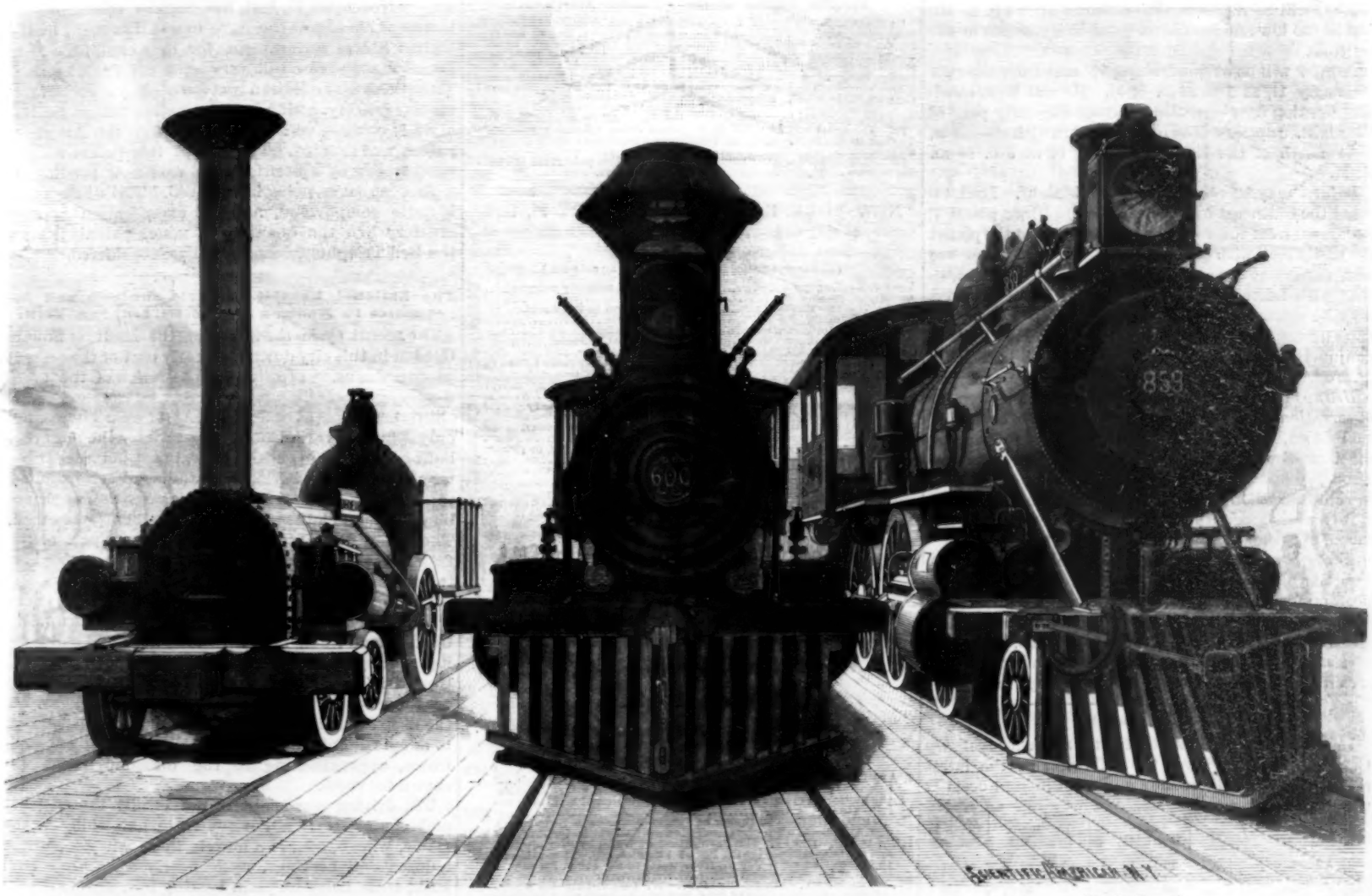
If, aside from the architectural display, the World's Columbian Exposition at Chicago was more notable for any one thing than another, the distinction lay in exhibits that mark progress in various arts, especially the mechanic arts. It is difficult to realize the advancement made in anything without a comparison of the new with the old, and as an opportunity for such comparison is seldom presented, the masses are apt to remain in ignorance.

The Columbian Exposition afforded an exceptional opportunity for studying everything relating to progress, but nowhere was improvement more noticeable than in the transportation exhibits, and especially among the locomotives. Here were shown the earliest and the latest, with all the intermediate stages. We have selected from the large number there shown three locomotives which mark epochs in railroading. The earliest of these is the Lafayette, designed and built by William Norris, of Philadelphia, in 1837. It was the first six-wheeled locomotive used on the Baltimore & Ohio Railroad.

This type of locomotive created a revolution in construction, both in Europe and in America, and was the most famous of its time. We illustrate a full size working reproduction, constructed from the drawings and details furnished by the descendants of the inventor. The Lafayette, which was built expressly for the B. & O. road, was one of the great trio of locomotives produced by William Norris, in 1836–37–38. The Washington, one of the three, was the first locomotive to overcome the steep grade at the Columbia Incline from the Schuylkill River west, at Philadelphia, and its performance in accomplishing what was deemed an impossibility was heralded throughout the world. The Lickey Incline, on the Birmingham & Gloucester R.R., in England, had baffled all European locomotive builders, and it was the opinion that it would have to continue to be operated by endless chain or cable.

The performance of the Washington and of the Lafayette, in America, led to an order for a similar engine for the Lickey Incline, as an experiment. Norris built the Philadelphia, sent it to England, and it climbed the incline with comparative ease. So successful was its work that five additional engines were at once ordered, and the entire system of the operation of the incline changed. The d mand in Europe for Norris engines assumed such large proportions that he eventually established himself in Vienna, designing and building the Royal Works there. Norris, in early life, was a druggist in Baltimore, and becoming acquainted with Col. S. H. Long, when the latter was associated with the surveys for the B. & O. road, the two subsequently entered into a copartnership to build locomotives. Long shortly afterward withdrew, and the Norris engines were for years the foremost in America. Joseph York, the first engineer of the Lafayette, is still living, and was in attendance upon the exhibit during the Exposition.

The second of which we make mention is the Baltimore & Ohio Company's engine 600. This engine was the company's model locomotive at the Centennial Exposition, 1876, and the first passenger Mogul built by the B. & O. R.R. Co. It was shown here just as at Philadelphia, having been taken from service and placed in original form. The 600 was regarded as representative of the highest type of the American locomotive seventeen years ago. Forney, in "Recent Locomotives," 1883, gives data as follows: Diameter of cylinders, 19 inches; stroke of piston, 26 inches; length of steam ports, 15½ inches; width of steam ports, 1¼ inches; width of exhaust ports, 2¾ inches; diameter of driving wheels, 5 feet; of truck wheels, 2 feet 7 inches; wheel base of engine, 22 feet 11 inches; total wheel base of engine and tender, 50 feet; diameter driving axles, 6¾ inches; length, 8 inches; outside diameter of smallest ring of boiler, 4 feet 2 inches; number of tubes, 165; length of tubes, 11 feet 10⅛ inches; outside diameter of tubes, 2¼ inches; length of fire box inside, 8 feet 3 1/16 inches; width, 2 feet 10⅛ inches; grate surface, 23 feet 7 inches; heating surface in fire box, 122 square feet; heating surface in tubes, 1,150 square feet; total heating surface, 1,272 square feet; weight of engine in working order, 90,400 pounds; weight on driving wheels, 76,550 pounds; weight of tender loaded, 60,400 pounds; total weight of engine and tender ready for service, 150,800 pounds, in round figures 76 tons. The 600 was built to run upon the division extending from Keyser to Grafton, which includes the Seventeen Mile Grade, averaging 116 feet to the mile, with curves of 600 feet radius. Forney, giving weight of average through trains, baggage, postal, passenger and Pullman cars, as 235,000 pounds, adds facts as to the schedule time showing an average of 27 miles per hour over the entire mountain division between the points named and one hour and five minutes up the Seventeen Mile Grade.



Lafayette. 600. Director General.

THE BALTIMORE & OHIO RAILROAD COMPANY'S EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION AT CHICAGO.

The Director General, 1893, the third of this series, is now the standard type of the Baltimore & Ohio Company's eight-wheel passenger engine, with Vauclain compound cylinders. It was built by the Baldwin Locomotive Works from designs, other than the compounding of the cylinders, by Mr. George B. Hazlehurst, general superintendent of motive power, B. & O. R.R.

The Director General will be assigned to service on the "Royal Blue Limited," between Washington and New York, and it is believed will equal, if not eclipse, the record now held by a Royal Blue engine of a mile in thirty-seven seconds, which is at the rate of ninety-seven and three-tenths miles an hour. The Director General's actual weight in working order is 126,780 pounds. Weight of tender with fuel and water, 72,080 pounds, making the whole weight in service in round figures a hundred tons. The wheel base of locomotive is 22 feet 4 inches, and of tender 17 feet, and the total length of engine and tender over all is 59 feet 6¼ inches. The diameter of the high pressure cylinder is 13½ inches and of the low pressure cylinder 23 inches;

stroke of piston, 24 inches; steam ports, 24 by 1½ inches; circular exhaust ports, the same. Piston valve. The diameter of the driving wheels is 6 feet 6 inches; truck wheels, 3 feet; length driving springs, center to center of hangers, 4 feet; steel boilers, 251 tubes of two inch diameter; length of tubes over the tube plates, 11 feet 10 inches; inside length of fire box, 107⅞ inches; inside width of fire box, 33⅜ inches; diameter of dome, 31⅛ inches; height, 22 inches; working steam pressure, 180 pounds; grate surface, 24¾ square feet; total heating surface, 1,693 square feet; heating surface of the tubes, 1,544 square feet; height from top of rails to top of smokestack, 14 feet 10¼ inches.

Planet Notes for February.

Mercury will be "evening star" during February. During the first half of the month he will be close to the sun, but in the latter part will be visible to the naked eye for a short time after sunset. He will be at greatest elongation, east from the sun 18°, on the evening of February 25. His greatest brilliancy will be attained on the evening of February 21. Mercury will be 10° due south from Venus at 9 h. 41 m. P. M. February 8, central time.

Venus will be visible as evening planet for but a few days in February. On the 16th, at 3 h. 4 m. A. M., she will be at inferior conjunction, *i. e.*, between the earth and sun. Venus will be in conjunction with the crescent moon, 11° north of the latter, at 3 h. 3 m. P. M. February 6.

Mars will be visible in the southeast after 4 h. A. M., but at too low an altitude for good observations in our latitude.

Jupiter will be at quadrature, 90° east from the sun, February 11, at 1 h. 52 m. A. M. He will be in excellent position for observation during the early part of the night. Jupiter will be in conjunction with the moon, 4° 34' north of the latter, February 13 at 3 h. 16 m. A. M.

Saturn may be observed after midnight. Look toward the southeast in the constellation Virgo, about 5° northeast from the star Spica. The rings of the planet are easily seen with quite a small telescope. They are now turned at an angle of 14° to the line of sight, so that with telescopes of moderate power the divisions may be seen. Saturn's apparent motion among the stars during February will be westward. He will be in conjunction with the moon, 4° north, at 8 h. 2 m. P. M. February 23.

Uranus rises about midnight, and is in position for observation from 3 to 6 A. M. He is in the constellation Libra, about 1° 45. east and 26' south of the star α. Uranus will be at quadrature, 90° west from the sun, February 3 at 7 h. 4 m. P. M. He will be stationary in right ascension February 18, and after that will move slowly westward. He will be in conjunction with the moon, 3° 36 north, at 9 h. 58 m. A. M. February 25.

Neptune will be at quadrature, 90° east from the sun, February 29, at 2 h. 36 m. A. M. He will be in good position for observation during February. He is almost stationary in Taurus, a little more than one-third of the way on a straight line from ι to ε Tauri. There is no star of equal brightness, *i. e.*, 8th magnitude, within a radius of 1°.—*Astronomy and Astro-Physics.*

Deep Sea Depths.

In a recent number of the *Popular Science Monthly* G. W. Littlehales gives the following as the latest reliable result of the sounding of the different oceans:

	Latitude. Deg.	Min.	Longitude. Deg.	Min.	Depth in Fathoms.
North Atlantic ocean	19	39 N.	66	26 W.	4,561
South Atlantic ocean	19	55 S.	24	50 W.	3,384
North sea (Skagerack)	58	12 N.	9	30 E.	442
Baltic sea	58	37 N.	18	30 E.	228
Mediterranean sea	35	45 N.	21	46 E.	2,405
Black sea	43	55 N.	33	18 E.	1,431
Caribbean sea	19	0 N.	81	10 W.	3,427
Indian ocean	11	22 S.	116	50 E.	3,366
North Pacific ocean	44	55 N.	132	26 E.	4,655
South Pacific ocean	34	37 S.	175	08 W.	4,428
Behring sea	54	30 N.	175	32 W.	2,146
Sea of Japan	36	30 N.	136	0 E.	1,640
China sea	17	15 N.	118	50 E.	2,350
Sulu sea	6	32 N.	121	55 E.	2,549
Celebes sea	4	16 N.	124	02 E.	2,794
Banda sea	5	34 S.	130	37 E.	2,790
Flores sea	7	43 S.	120	26 E.	2,799
Arctic ocean	78	06 N.	3	30 W.	2,469
Antarctic ocean	62	30 S.	95	44 E.	1,975

A Long Siphon.

According to *Indian Engineering*, a long siphon has lately been added to the water supply system of the Nusseerabad cantonment in India. The water is drawn from a well in the overflow channel of a lake; a weir below the well preventing any serious fluctuations in the water level in the latter. Until recently, the water has been pumped by bullocks from the well into a main leading to the cantonment. Toward the end of August this method of supply was discontinued and a siphon service put in. It is an eight-inch pipe, about four miles long, having a variation in level between its summit and the water in the well of from two to twelve feet, and a difference between its summit and the water in the service reservoir of from nine to seventeen feet.

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(Illustrated articles are marked with an asterisk.)

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For the Week Ending January 27, 1894.

Price 10 cents. For sale by all newsdealers.

THE MUNICIPAL ART SOCIETY.

Some of our most able and distinguished citizens have lately formed an organization under the title of the Municipal Art Society, having for its object the promotion of a more artistic and refined taste in the embellishment and decoration of public buildings, parks, and places.

For lack of such an organization various crude devices, under the name of art, are constantly being imposed upon the city. It will be the aim of the society to look after and correct all such matters.

The society intends to expend large sums for the encouragement and realization of municipal art works, the money being secured from the annual dues, at five dollars each, of many thousands of members. This is a movement worthy of the active support and assistance of every intellignt citizen.

Expiration of the Bell Telephone Patent.

At last the long-waited date is at hand. With the expiration of this month comes the expiration of the second fundamental Bell telephone patent. Over a year ago the undulatory current passed into history. Next to disappear from life is the iron or steel diaphragm magneto-telephone, exemplified in the telephone receiver now in use. For many services this instrument can be used as a transmitter—of course far inferior to the microphone, but capable of service on short lines. The carbon transmitter is still protected to a great extent by fundamental patents of uncertain validity. Among these the Berliner patent of November 17, 1891, has become celebrated; its tenure of life is now the issue in a suit brought by the United States government for its annulling. It is hoped that the case will very soon come to a hearing. Then there is the Edison patent of May 3, 1892, of uncertain validity, owing to the English patent for the same invention, which expired before the American patent was granted. The fate of this patent will depend largely on a decision in a case now pending in which the same point is involved. The whole affair is quite complicated, and its complication appears greater when the quantity of minor patents held by the Bell Telephone corporation are considered.

The National Exhibit of Cycle Sundries and Accessories in Madison Square Garden, New York.

The recent cycle show held at the Madison Square Garden in this city during the early part of the present month was an impressive demonstration of the great development of this manufacturing interest and of the allied branches of industry. At it were shown, not only the many varieties of cycles, now for the most part built on the same general lines, but the trades tributary to the cycle world, from India rubber manufacturer, drop forger and steel ball maker to the supplier of bicycle riders' clothes and shoes, were there represented. The entire display, occupying the greater part of the floor space of the great building, and overflowing into the galleries, was most impressive and beautiful.

The bicycle exhibits were so numerous that a description of all is out of the question. For men riders the diamond frame type with long head and ball bearings throughout rules supreme. The geared ordinary, front-driving safety, and giraffe or high frame safety are the exceptions, but are only exceptions. For ladies the drop frame is made. As the fair sex seem inclined to adopt rational dress for wheeling, a modified drop frame, approximating to the diamond frame, was shown for them.

The driving gear is almost universally the sprocket and chain. It is a curious fact that while on the frame, wheels, etc., of a bicycle there will be perhaps a dozen ball bearings, using nearly a hundred steel balls, there being no plain bearing left, the chain may by itself present a hundred plain old-fashioned bearings, of the type used for centuries before modern machinery was thought of. This is now the troublesome part of the modern cycle. All attempts to improve it by roller sleeves and the like are imperfect. Another peculiar thing in this connection is that the chain is exposed to rain, dust and mud to further develop its bad qualities. The perfect chain and gear case, keeping off rain and dirt, and supplying oil *ad libitum*, seems to be still in the future.

One method of doing away with the chain was shown by the League Cycle Co., of Hartford, Conn., who have substituted for the chain a bevel gear, inclosed in the tubing and in cases. This not only abolishes the chain, but affords a wheel ridable in every day clothes without any special precautions, such as trouser clips. How the frictional resistance of bevel gear and of sprocket gear will compare is uncertain. The exhibitors contrast the four pieces of their gear with the two hundred and four parts found in some chains with their sprockets.

Another wheel was built, in one sense, on the opposite principle, as the front as well as rear wheel was fitted with a sprocket and chain gear. On the front wheel it operated by pumping the handle bars up and down, thus adding the power of the arms to that of the legs. This was shown by Mr. H. J. Bauer, of Elizabeth, N. J.

Several examples of changeable gear were exhibited.

Some of these could be operated while riding, enabling the gear of the wheel to be instantly changed from high to low or *vice versa*.

Steel balls, as exhibited by two firms, the Simonds Rolling Machine Company, of Fitchburg, Mass., and the Cleveland Machine Screw Company, deserve special mention. The first named company had their Chicago exhibit of balls, ranging in size from a diameter of nine inches to one two-hundredth inch. They also showed steel projectiles and many other articles rolled by their process. The Cleveland Company, formerly the Grant Antifriction Ball Company, had a most interesting exhibit, including balls of large and small diameter. They turn the balls from the bar or rod cold, hammer forge the larger ones, and grind, harden, and temper by special methods.

A great variety of pneumatic tires were shown. The plain "hose pipe" tire is the favorite with many, while the laced inner tube tire is still used in great quantities. These are cemented to the rim. Mechanically fastened tires with quickly detachable outer cases were the feature of this portion of the show. It is clear from their variety, and from the persistence of the two earlier types mentioned above, that there is room for invention here.

An odd and ingenious application of the bicycle motion was due to the Hanson & Van Winkle Company, of Newark, N. J. They show a saddle post with treadle gear mounted on a fixed standard, working a plating dynamo. Thus a repairer can take his bicycle exercise in his shop and plate his goods at the same time.

The Garvin Machine Company, of this city, exhibit a full line of machinery, designed for the manufacture of cycles and cycle parts. It includes drill presses, milling machines, screw machines, roll thread machine for spokes, a wheel truing machine and others, indicative of the development of the cycle industry.

Among the cycles proper may noted the exhibits of such firms as the Pope Manufacturing Company, who had their pavilion from the Chicago Exposition erected, and filled with a beautiful exhibit, and the Overman Wheel Company, who had an equally impressive display. The latter firm showed in operation an ingenious machine for determining and marking on an indicator card the relative resiliency of pneumatic tires. The John P. Lovell Arms Company, of Boston, Mass., and the Remington Arms Company, of this city, had beautiful exhibits of wheels. The Eagle Bicycle Manufacturing Company, of Torrington, Conn., exhibited wheels with cold swaged tubing and aluminum rims on the wheels. The New Mail wheel was shown by William Read & Sons, Boston, Mass. The Warwick Cycle Manufacturing Company, of Springfield, Mass., and the Monarch Cycle Company, of Chicago, also deserve mention. The MacIntosh-Huntington Company, of Cleveland, Ohio, not only had regular type wheels, but also front drivers, both safety and geared ordinary.

Chains, different kinds of tubing, including aluminum tubes, lamps, bells and saddles, among the latter air-inflated or pneumatic saddles, shown by the Parsons & Muller Manufacturing Company, of New York, and drop forgings are examples of the things other than wheels presented at the show. Whether it be taken as a popular or as a trade exhibit, the affair was a great success.

Dr. Klumpke.

Mlle. Klumpke, who has just gained the degree of Doctor in Mathematical Sciences at the Sorbonne, is the first lady who has obtained that distinction. The full title of her thesis was "Contribution à l'étude des anneaux de Saturne," and the following is a translation by *Nature* from *La Nature* of the complimentary terms in which M. Darboux addressed the gifted authoress in granting her the degree:

"You have occupied yourself with one of the most interesting questions in astronomy. The great names of Galileo, Huyghens, Cassini, and Laplace, without speaking of those of my illustrious colleagues and friends, are connected with the history of each of the great advances in the attractive but difficult theory of the rings of Saturn. Your work is not a slight contribution to the subject, and it places you in an honorable position among the ladies who have devoted themselves to the study of mathematics. During last century Mlle. Marie Agnesi gave us a work on the differential and integral calculus. Since then Sophia Germain, as remarkable for her literary and philosophic talent as for her mathematical faculties, was held in esteem by the great geometers who honored our country at the beginning of this century. And but a few years ago the Academy of Sciences, on the report of a commission in which I had the honor to take part, awarded one of its best prizes to Mdme. Kowalewska, placing her name by the side of those of Euler and Lagrange in the history of discoveries relating to the theory of the movement of a solid body around a fixed point. In your turn you have entered upon your career. We know that for some years you have devoted yourself with great zeal and success to investigations connected with the star chart. Your thesis, which you have prepared according to our course of higher mathematics, with an assiduity that we could not ignore, is the first that a lady has presented and successfully sustained before our Faculty to obtain the degree of Doctor of Mathematical Sciences. You have worked in a deserving manner, and the Faculty has unanimously decided to declare you worthy of the grade of Doctor."

Results of the Copyright Law.

The new international copyright law has been in operation over two years, and in some respects it is possible to judge of its operation within that time. Mr. G. Haven Putnam, who is well informed on this subject, treats it briefly in the January *Forum*, as it affects American and foreign authors, American readers and American publishers. American authors have been disappointed in its results. They have not obtained the English returns which they expected from the protection of their works by an English copyright, and though the sales of their books in foreign countries are on the increase, they are hardly yet what might be expected. On the other hand, English authors have been also disappointed in the sale of their books in America. The demand for English fiction has greatly fallen off, and the result is that the English have not gained at all what they expected when they could control their own books. In neither case has the international copyright law done for authors what it was hoped that it might do. They are not much better off than they were before. But there has been eliminated from the book publishing trade a great deal of fiction which was worthless in itself, and for which there was no legitimate demand. American readers have not been deluged with cheap fiction.—*Boston Herald*.

It might also be added American readers have not enjoyed the benefit of so many cheap editions of high class works of every description.

Promoting Ingenuity.

It may not be generally known, says the *Railway Review*, that Messrs. Denny grant to the workmen in their shipbuilding yard at Dumbarton a sum of money for suggestions for the improvement in plant, etc., likely to facilitate or cheapen production. During the year past 57 new improvements have been considered, and of this number 38 have been successful, 15 rejected, and 4 postponed. The total sum expended during the year was $720; of this sum $480 was paid in ordinary awards and $240 in premiums. The number of awards and the amount of money expended are not only much greater than those of last year, but are the third highest in any year since the scheme was started. Fully two-thirds of the total number of claims received were successful, as against an average of 52 per cent for the fourteen years the scheme has been in operation. The workmen in the iron department have this year succeeded for the first time in sending in more claims than those of any other department, while the electrical department has been successful above all others, considering the number of workmen connected with the branch. Since the introduction of the scheme, 602 claims have been received, 313 being successful and 289 rejected. The total sum expended is $7,400, of which $5,170 was paid in awards and $2,230 paid in premiums. The sum of $4,840 has been gained by eighteen claimants.

How to Cultivate the Body.*

The ancient Greeks gave the important subject of physical culture very careful attention, and were rigid in exacting for their youth a gymnastic training. Even the girls of Sparta were expected to be good gymnasts, and no young woman could marry unless she was proficient in various exercises. Consequently the bodies of both sexes were healthy and beautifully developed. Their minds were also highly developed, but not at the expense of the body, as is generally the case nowadays. Grecian philosophers and physicians believed that the mind could not possibly be in a healthy state unless the body was in perfect health, and acted accordingly. It would be well if with us it was compulsory for parents to give their offspring a course of physical training.

General physical exercise is the kind required for boys and girls, and it is essential that judicious systematic training be pursued. This can be had only at public or private schools where physical culture is obligatory, or at well conducted gymnasiums, where there is a system for training the body in a rational way. Many people think that a gymnasium is a place for sporting men. This is a mistake. Clergymen, doctors, students, clerks, governesses, and society people frequent respectable gynasiums. The gymnasium of to-day is a very different place from that of fifty years ago. Formerly the aim of the gymnast was to turn out men who could lift heavy weights and court death on the flying trapeze. Nowadays all this is changed: physical training is carried on in a scientific manner; men of ability have made physical culture a profession, and their object is to make pupils healthy, strong and graceful. Most modern gymnasiums have appliances for the cultivation of every part of the body, and able instructors and physicians in attendance.

I advise all young and middle-aged men and women to spend an hour daily in earnest systematic physical exercise. The best plan is to enter a gymnasium where some system is employed. There are several systems of physical training—the Swedish, the German, the English, and the so-called American. The Swedish and the German are considered by competent judges to be the best. The teachers of the German system claim that it is the best because it aims at general physical culture, and that it keeps the mind as well as the body in a wholesome activity. This system was founded by Jahn in 1810. It embraces three departments, school gymnastics, popular gymnastics and military gymnastics. The founder's aim was to make the youth of Prussia strong and courageous to defend their country when needed, and from his idea the present German system of gymnastics has grown. The Swedish system was devised by Ling at the commencement of this century, and has been improved by his followers, who assert that it aims at an harmonious relation of body to mind, and that it is the best for the development of the fundamental functions. It is a system of voluntary movements arranged and executed with care. The movements comprise leg movements, which increase circulation and regulate the action of the heart; back and chest movements, which strengthen and expand the lower part of the chest; heave movements, which strengthen the arms and the upper part of the chest; shoulder movements, to pull the shoulders back; respiratory movements, balance movements, abdominal exercises, etc. The English system of free athletic exercises has been tried with great success in France. No doubt it has a wonderful influence on the moral and social qualities of the young. The so-called American system is a mixture of the German and Swedish systems. Our teachers of physical culture take the best ideas from all systems, and find that the combination works well.

I do not advocate any particular system. My aim is to suggest practical means whereby the body can be cultivated. The Swedish, German, English, and American systems are all good, and either, judiciously followed, will bring about the desired result. Gymnastics should be directed toward promoting the healthy activity of the organs that make blood, to correcting defects, and to the perfection of the human figure. The most helpful movements are also the most beautiful. The Greeks cultivated the body as no other nation has done, with this result. In training, one should begin slowly and build up the weak parts first; then exercise should be taken so as to bring nearly all the muscles into action at the same time. This stimulates the action of the heart and lungs, besides increasing the circulation and respiration. Many muscles of the body, from lack of use, waste away. The technical term for this wasting is atrophy, and to avoid it every muscle in the body should be exercised regularly. Light, quick exercise is the best. Heavy dumb-bells or pulley-weights should not be used. One hour's vigorous exercise daily is all that is needed, and should always be followed by a tepid bath. Avoid everything that throws extra strain upon the heart, and aim at the correction of errors of nutrition.

All who can possibly enter a gymnasium should do so, for public gymnasiums are now so conducted that by following the directions of the instructors it is almost impossible to exercise in such a way as will be detrimental to health; but those who are unable or unwilling to do this can by simple means build up and improve the body at home. For strengthening and developing the legs nothing can be better than walking. A simple but most useful exercise, which all can practice, is that of breathing. When the breathing capacity is increased, the general health is improved. For the breathing exercise, throw the head up, the shoulders back, and the chest out; inflate the lungs through the nose until full; then exhale quickly until the lungs are empty, and finish with long-drawn inspirations. This should be done, if possible, out of doors. For strengthening and developing the upper part of the body a pair of light dumb-bells is all that is needed. Physical exercise should be taken regularly and continued through life. It is a remedy against many of the diseases prevalent at the present time. I urge all who desire strength, health, and beauty to take plenty of outdoor exercise in addition to the home or gymnasium exercises. Outdoor exercises help to the development of the respiratory organs.

* Wilton Tournier in *Lippincott's Magazine*.

Artificial Ice.

The Massachusetts State Board of Health concludes, from investigations of artificial ice, that artificial processes of freezing concentrate the impurities of the water in the inner core or the portion last frozen, that the impurities are least if distilled water is used, that the number of bacteria in artificial ice is insignificant, under the prevailing methods of manufacture, and that the amount of zinc found in ice is insufficient to cause injury from its use.

COMPARATIVELY RECENT GEOLOGICAL CHANGES IN CALIFORNIA.

Professor Andrew C. Lawson, Ph.D., of the Department of Geology and Mineralogy of the University of California, is the author of a paper recently published in the Bulletin of the University on the Post-Pliocene Diastrophism of the Southern California Coast, and which is well calculated to enlist the interest of geologists in the comparatively recent changes which have taken place in that locality. As stated by the writer, "the recency of the record, the vastness of the events, the precision with which they may be established," all contribute to give the study high importance, as "nowhere is the record so legible, nowhere will greater discoveries reward the researches" of the geologist.

The conception of the general uplift of the coast is borne out by what is known of the topography and geological character of the chief river valleys, our illustration, furnished by Professor Lawson, representing the Pliocene delta of one of the most important of these valleys, the Santa Clara-San Benito. The total length of the depression, which contains the Bay of San Francisco, is about 150 miles, its breadth at the bottom varying from that of a headwater gorge to about 17 miles at the bay. The valley is occupied by a trenched and terraced Pliocene delta, its upper portion showing the delta in a great volume of approximately horizontal gravels. These gravels are exposed in a series of very remarkable cliffs, often over 1,000 feet high, which are "being developed by a vigorous sort of sculpture which yields the effects of a 'bad land' topography," as shown in the picture. "The trenching and terracing action of the streams, as they have by stages dissected the delta during the progress of the uplift, has left remnants of it in the form of isolated hills and plateaux in the middle of the valley. One of the highest of these lies just above the confluence of the Tres Pinos and the San Benito, between the two streams. This plateau shows magnificent cliff sections, particularly on the San Benito side, and the character of the ridge as a series of well bedded gravels from top to bottom is evident to the most casual glance. The bedding is either horizontal or is tilted to the eastward at angles up to perhaps 15°. The altitude of the summit of the gravel plateau was made the subject of careful measurement. By the use of the mercurial barometer the summit was found to be 929 feet above Tres Pinos station. The latter is given in the railway levels at 514 feet above sea level. The summit of the plateau is thus 1,443 feet above sea level. It is clear, from the character of the ground, that the summit of the plateau is not the original summit of the delta formation; much has been removed by erosion. Further up the valley, also, these same gravels are known to the writer to be several hundred feet higher than on the plateau near Tres Pinos. The summit and slopes of the plateau are distinctly terraced at various levels."

In conclusion, the author holds it as clearly established that a recent uplift of the continental margin has taken place from the Golden Gate to San Diego, the rise being from 800 to 1,500 feet, and the uplift probably extending far to the south and far to the north of these limits, the physiography of the country having thus been radically changed in the most recent geological times.

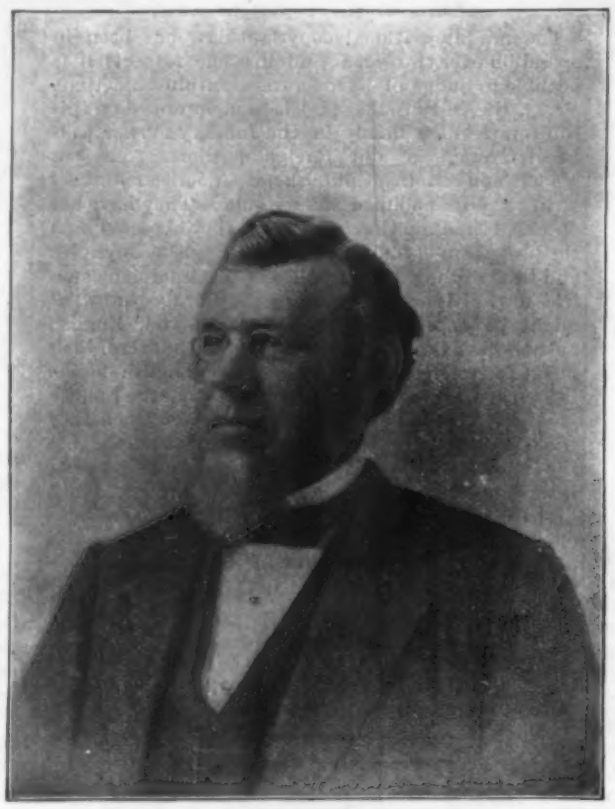
RECENT GEOLOGICAL ACTION, SANTA CLARA-SAN BENITO VALLEY, CAL.

Pure Iron.

Professor Arnold recently produced, with the aid of aluminum, a sound ingot and bar containing 99·81 per cent of pure iron. So far no absolutely carbonless iron has been obtained commercially. An analysis of Professor Arnold's bar by Mr. R. A. Hadfield showed the following composition: Carbon, 0·07 per cent; silicon, 0·04 per cent; sulphur, 0·03 per cent; phosphorus, 1·015 per cent; iron, 99·81 per cent; total, 100·035 per cent. Its specific gravity was 7·863; limit of elasticity, 18 tons per square inch; breaking load, 23 tons per square inch; elongation, measured on 2 inches, 49·25 per cent; reduction of area, 69·60 per cent; fracture, silky.

THE LATE NATHANIEL WHEELER.

The death of Mr. Nathaniel Wheeler brings to mind much that is of interest concerning the early history of the great industry which has since made the name of the American inventor famous, both in this country and abroad. The American sewing machine has found its way to almost every country of the globe, whether civilized or uncivilized. It was a curious sight at the World's Fair to see the position that it occupied in almost every household in that little community of Javanese, who, by their quaint, retiring manners and attractive ways, won our sympathy and attention. The sewing machine was to be found on every piazza, and the fact of its almost constant operation did much to show the industry of these little people. The sewing machine as an American invention has attained more than a national reputation, and the fortunes that have been amassed by it have become world-famed. During the very early days of the SCIENTIFIC AMERICAN a quiet little man came to the office, bringing with him a model of a machine which was destined, in course of time, to make him and his partner famous. This machine was the prototype of the celebrated Wheeler & Wilson sewing machine, and it was first opened to public inspection in this office. The inventor and demonstrator was Mr. Wilson, whose name has for so many years been linked with Mr. Wheeler.



NATHANIEL WHEELER.

After his patents were obtained he was brought into communication with the subject of this sketch, a man already successful, and himself an inventor. Probably no more fortunate combination could have been made than when these two strong characters joined interests and determined to develop a mere mechanical idea into a commercial reality. Mr. Wheeler, by his energy, push, clear judgment, and business ability, in conjunction with his partner, whose mind was fertile with ideas, started their manufactory, which has grown and expanded until it has become an immense enterprise and one of the great sources of wealth to its native place, Bridgeport.

Nathaniel Wheeler was born in Watertown, Conn., September 7, 1820. His father was a carriage maker, and the son worked at the trade, making quite a reputation as a painter of taste and ingenuity in the decoration of carriages and the old fashioned sleighs, which were profusely decorated with stripes and ornaments. At the age of 21 he took the business on his own account, his father retiring to a farm, and conducted it about five years. At that time the manufacture of small metallic wares had become an important industry in Waterbury, and he decided to engage in it. Buckles, buttons, eyelets, were among the goods made, and beginning with tools for hand work only, he introduced machinery of various kinds. Among the articles he produced were the polished steel slides for ladies' belts, etc. He was among the first to make them in this country. The price was at first eight dollars a gross, but was reduced to twenty-five cents a gross through the improvements he made in machinery and methods of production. The firm of Warren & Woodruff were making similar goods in Watertown, and were also interested in a suspender factory. In 1848 this firm joined both of their interests with Mr. Wheeler's, under the name of Warren, Woodruff & Wheeler, Mr. Wheeler taking the full charge, and with such success that he was seeking other branches of work to add when he was by accident introduced to the sewing machine invention. From that time Mr. Wheeler's business history is that of the Wheeler & Wilson Company, and for most of the time of the town and city of Bridgeport. Mr. Wheeler occupied a prominent place in the affairs of his city and State. He had large holdings of real estate in every section of the city, and was interested in some other manufacturing concerns. He was a director of the Consolidated Railroad, the Mountain Grove Cemetery Association, the City National Bank.

Mr. Wheeler was a representative from Bridgeport to the General State Assembly for four terms several years ago. He also represented his district in the State Senate two terms, and was one of the commissioners for the building of the State Capitol at Hartford. In his younger days he served several terms in the Common Council. He was a Park Commissioner for a long while. In 1876 he was appointed as a commissioner of the State of Connecticut for the World's Fair at Philadelphia.

Mr. Wheeler was twice married. His first wife, Miss Huldah Bradley, of Watertown, to whom he was married in 1842, died in 1857. There were four children by this marriage, two of whom are living—Samuel H., of Chicago, and Ellen B., the wife of Edward Harrall, of Fairfield, Conn. His second wife, who survives him, was Miss Mary E. Crissey, of New Canaan. By this marriage there were also four children, of whom two are alive and reside with their parents. They are Archer Crissey and William Bishop, twins, born in 1864. They have been associated with their father in the management of his private business and with the Fairfield Rubber Company.

Mr. Wheeler's inventions, as shown by the patent records, are as follows: In 1870, and again in 1878, he patented wood filling compounds now in genera use. In 1876, with J. A. House, he patented a power transmitter

clutch; in the same year, with Philo M. Beers, an improvement on a former invention of Beers' for polishing needle eyes. In 1878, a refrigerator. In 1883, a ventilating arrangement for railroad cars; also a system of heating and ventilating houses. In 1885, with Wilbur F. Dial, the eccentrically-centered loop taker; also the feed regulator for the No. 13 machine, two patents. In 1890, the barred hook used in the No. 2 machine, two patents for tension release, and one for combination of parts in the No. 9 machine. He also patented a design for cabinets.

We are indebted to the *Sewing Machine Times* for the engraving and for some of the data contained in the sketch.

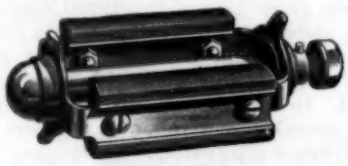
COLUMBIA BICYCLES FOR 1894.

The Pope Manufacturing Company announce a number of new wheels for 1894, and we illustrate model

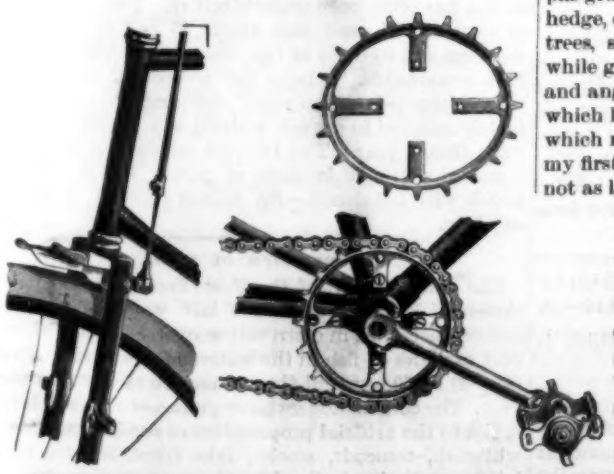
COLUMBIA BICYCLE, MODEL 34.

34. This, while a new machine in many important points of design and construction, retains also the best features of their former light wheels. It weighs 30 pounds with or 29 pounds without brake. It is made for expert and intelligent riders, who take good care of their cycles, and if used as any finely constructed piece of mechanism should be, will give the highest satisfaction. It is furnished with Columbia single tube pneumatic tire, but Hartford double tube tire will be supplied, without additional charge, when desired.

We show in this connection the new front wheel



NEW PEDAL.



FRONT WHEEL BRAKE. SPROCKET WHEEL WITH DETACHABLE RIMS.

brake, which is used with this model. The newly designed forged spoon will be found strong and effective, while so acting on the tire as to reduce to a minimum any danger of wearing or cutting.

A novel feature of all models is the new front sprocket wheel, shown in illustration, the rim of which is easily and quickly detached without removing the pedal. By providing himself with one or more extra rims, either round or elliptical, and detachable chain links, any rider may effect a change of gear as required with little labor or delay.

A new pedal will also attract attention on account of a great saving in weight as well as additional neatness in appearance. These pedals are made in three widths, 3¼, 3⅝, and 4 inches. The great elasticity of the pneumatic tire admits of doing away with some of the rubber used in the old style pedal, making a saving in weight in this as well as in the frame.

Among other specialties announced for this year are the new Hartford double tube tire and the adoption of wood rims in some of the lighter wheels. The Columbia seamless tube is used in the construction of the frames. This is the strongest for its weight ever used by the Pope Company and the most uniform in gauge and tensile strength, as not only established by their own tests, but by those of the government testing department at Watertown, Mass.

The steady advance made by this company, the pioneer in the cycle industry in this country, is well known, and the great interest aroused on the subject of good roads is due to the persistent work of Col. A. A. Pope.

The reduction in price announced will be welcome intelligence to the great number interested in bicycling, and will cause these wheels to be used more widely than heretofore.

The forty-eight page catalogue issued by this company is profusely illustrated and beautifully printed. It will repay careful examination by any one interested in bicycling. All of the different wheels and parts are fully described. These catalogues may be had, free of charge, at any office or agency of the company, or will be mailed on receipt of four cents in stamps from their offices in Boston, New York, Chicago or Hartford.

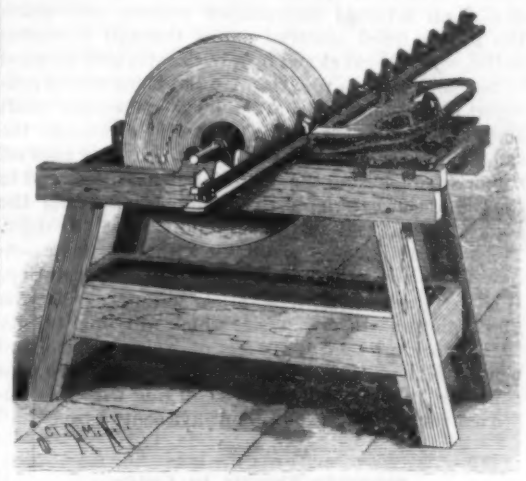
The Humming Bird at Home.

While spending the winter in California, I made my first acquaintance with Madam Hummingbird "at home." In the first place the location could not have been improved on. Just picture in your mind a lawn dotted with orange, lemon, fig, and palm trees, with here and there a giant century plant, or bunch of pampas grass and no end of flowers. While a cypress hedge, overshadowed by stately eucalyptus and pepper trees, separated the lawn from the street. One day while gathering oranges, I was startled by the rapid and angry darting of a humming bird near my face, which led me to look closely in that part of the tree, which resulted after a little search in the discovery of my first humming bird's nest. It was placed on a twig not as large as a lead pencil, on one of the lower limbs of the orange tree, and it was so covered with lichens the same color as the bark of the tree that it was difficult to find it again even after I knew about where it was. The nest is about the size of the burr oak acorn cup, built almost entirely of the feathery plumes of the pampas grass, covered with green lichens, and all held together, and to the limb, with something greatly resembling spider web. Within this "marvel of construction" were two semi-transparent eggs, almost too small to describe, and my efforts to use the blowpipe on them blew them all to smithereens.

Before taking the nest, I visited Madam Hummingbird several times, and nearly always found her at home. She never left the nest but a few minutes at a time.—*Frank Ford, Mag. of Nat. Sci.*

AN IMPROVED SICKLE GRINDER.

This is a device which may be attached to the frame of an ordinary grindstone, to support the sickle in the proper position against the stone in grinding, preserving each section of the sickle uniformly true from heel to top. The improvement has been patented by Mr. Thomas Gordon, of South Bend, Wyoming. The base plate of the adjusting frame slides in guide cleats secured upon the beams of the grindstone frame, and on the base plate is a bed adjustably connected with the plate by means of a set screw serving as a pivot and another set screw in a segmental slot, the slot having at one side a scale to indicate how far to the right or left the bed is to be moved to give the proper beveled settings to different sized sections of the sickles. Pivotally connected with the bed is an adjusting frame having an outer handle section and opposite extensions in which are slideways adapted to receive a sickle-carrying bar, for holding in position the sickle to be ground. Near each end of the carrying bar is a post with pivoted yokes

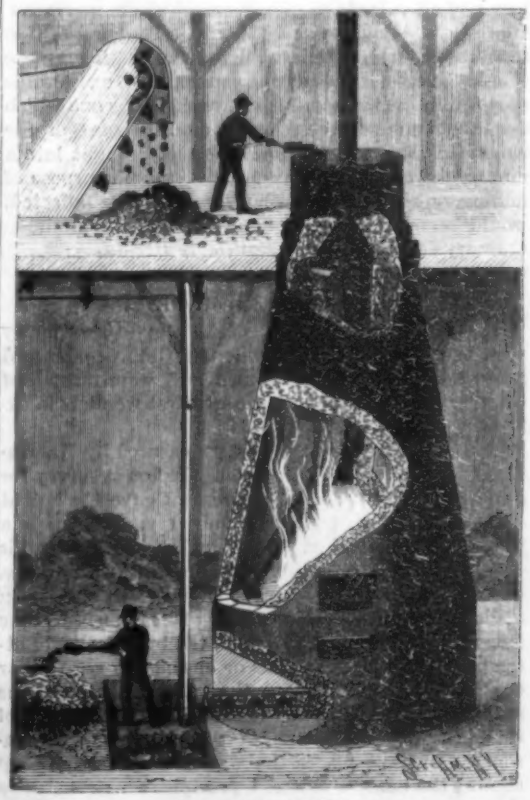


GORDON'S SICKLE GRINDER.

adapted to be clamped in any position they may be set, while intermediate posts are adapted to support the sickle bar to prevent its springing away from the stone during the process of grinding. The base is kept fed to the grindstone by a spring connected with a bracket, and the carrying bar may be manipulated by a shaft on whose outer end is a hand wheel, its inner end carrying a pinion meshing with teeth on the under face of the bar, the latter being carried either to the right or left by turning the hand wheel, it being designed that one revolution of the shaft shall carry the sickle to the right or left the length of one section. Instead of operating the sickle-carrying bar by means of this shaft, it is in many cases slid by hand either to the right or left. In use the stone is maintained perfectly square across its full face, the sickle sections passing over and across the entire face surface of the stone. The machine may also be adapted to the uses of an ordinary grindstone. Further information relative to this invention may be obtained of Mr. J. G. Pratte, Cheyenne, Wyoming.

AN EFFICIENT AND CONTINUOUS DRIER.

This improved drier, patented by Mr. William Harmon, of Bartow, Fla., is designed to save all the heat, the material to be dried being fed directly over the fire, while large quantities may be continuously treated, the material being carried down through the drier by gravity. Within the shell is a grate, beneath which is an ashpit, secured to a horizontal partition, suitable doors and air inlet apertures being provided, and within the conical part of the exterior shell is an interior concentric shell forming an outer annular space for the passage of part of the material to be dried, the lower end of this space being adapted to be closed by a series



HARMON'S DRIER.

of hinged segmental trap doors, which swing downward to discharge the material on the withdrawal of supporting pins. A suitable distance above the grate, and centrally in the drier, is a pipe leading to the funnel-shaped end of an inverted cone-shaped flue, and this flue is surrounded by a concentric shell, forming with the smoke flue an inner annular space for the passage of part of the material to be dried, another heating chamber being thus formed directly above the grate bars, and having cone-shaped discharge pipes under the ash pit. In the cylindrical lower end of the shell is an inverted cone-shaped bottom, over which the finally dried material passes through a central outlet, opened and closed by a horizontal gate adapted to be operated by a rod, the material being thence conveyed to the outside by a conveyer screw on a shaft actuated from any suitable source of power. In the smoke flue are openings through which may pass off steam or gases from the material being dried, and in the top of the exterior shell are gauges indicating the amount of material in the inlet portion of the drier. The construction may be durable without being expensive, and is not liable to get out of order in operation. It is designed for a wide variety of uses, as drying grain, phosphates, etc., a size which will hold twenty tons of rock presenting 700 feet of drying surface, and being designed to dry from twenty to thirty-five tons per hour. The ordinary cost of drying with this improvement is estimated at about five cents a ton.

Scientific Experts in Court.

One of the papers read before the American Chemical Society, at its recent meeting in this city, deserves special mention. It dealt with the subject of expert testimony in cases of capital crime, where the chemist is called in to analyze parts of the human body, with a view to ascertain the presence of poisons in the vital organs. The paper was prepared by a man of experience in such matters, and after citing numerous instances in which he had been summoned himself to give testimony, he advanced the theory that the chemical or medical expert engaged in murder trials should be summoned by the court rather than the lawyers on either side in the case. The wisdom of the proposed innovation turns upon the duty of an expert in a murder trial. Under existing circumstances he is expected to answer only the questions propounded, and the idea prevails among criminal lawyers that the expert belongs to the side which employs him, and that his testimony must fit into their theory of prosecution or defense.

The paper, however, showed the folly of pursuing such a course in the matter of expert testimony, and the writer cities an instance in which the analysis of a man's stomach showed the presence of both zinc and arsenic. The zinc was undoubtedly injected into the body in the process of embalming, and the supposition was that the arsenic was taken before death and was the cause thereof. But the chemist was not allowed to mention the presence of zinc during the trial, and the favorable doubt which its presence in the analysis involved was not allowed to go to the credit of the prisoner. In other words, the witness was not permitted to state the truth and the whole truth.

The most unsatisfactory results brought out in modern criminal trials center in expert testimony. Not only do learned chemists and physicians contradict each other, but their testimony serves to befog the jury and often leads to disagreement where no reasonable doubt would exist otherwise. The proposition that the expert in trials involving the death sentence should be summoned by the court and be answerable only to him, as the court stenographer is, is one which deserves thoughtful consideration on the part of the American people. A reliable chemist, brought into a murder trial by the court for the express purpose of finding out the truth, whoever might be affected, would serve to bring about a new state of affairs in ordinary criminal trials.—*Baltimore Herald.*

The Great Wall of China.

It would seem from the account of this extraordinary work that there was a time when the Chinese possessed a most remarkable persistence and were masters of what is even now one of the greatest wonders in existence.

This great wall was recently measured by Mr. Unthank, an American engineer engaged on a survey for a Chinese railway. His measurement gave the height eighteen feet. Every few hundred yards there is a tower twenty-five high. The foundation of the wall is of solid granite. Mr. Unthank brought with him a brick from the wall, which is supposed to have been made 200 years B. C. In building this immense stone fence to keep out the Tartars, the builders never attempted to avoid mountains or chasms to save labor or expense. For 1,500 miles the wall goes over plains and mountains, and every foot of the foundation is of solid granite, and the rest of the structure solid masonry. In some places the wall is built smooth up against the bank or crosses a precipice where there is a sheer descent of 1,000 feet.

Small streams are arched over; but on the larger streams the walls run to the water's edge and a tower is built on either side. On the top of the wall there are breastworks or defenses facing in and out, so that the defender's forces can pass one tower to another without being exposed to an enemy on either side.

To calculate time of building or cost of this wall is beyond human skill. So far as magnitude of the work is concerned, it surpasses everything in ancient or modern times of which there is any trace. The Pyramids of Egypt are nothing compared with it. I have heard Chinamen in California tell about it, but scarcely believed their stories. J. E. EMERSON.

A Method for Increasing the Contrast in Photographs.

If the negative is very weak, print until the shadows are darker than is desired in the finished picture. There is quite a little latitude in the printing, and experience will soon teach the right amount. Tone as usual, but bear in mind that under the following treatment the silver, not the gold, is dissolved, so that the finished print will have the appearance of having received further toning. If an absolutely black and white picture is desired, the toning should be carried tolerably far.

After toning immerse in the following, which should be made up fresh for each batch of prints:

Ferricyanide of potassium	1 gr.
Water	16 oz.
Nitric acid	30 minims.

Leave in this for from one to five minutes, according to the contrast needed. The time cannot be told accurately by the appearance of the prints, for they are reduced very little in this solution.

After removing, wash slightly and place in fixing bath, which is made as usual; and in the case of Solio paper, use the formula given by the makers. In the fixing bath the prints rapidly become lighter, and if they have remained long in the previous bath the contrast produced will be very great. Leave in the fixing bath perhaps a little longer than usual to insure the removal of all the silver salt. When fixed, wash as thoroughly as usual.

The reduction is due to the solution of the silver by the ferricyanide, and the increase of contrast may be easily explained as follows: Let the amount of deposit of silver per unit area on one part of the print be denoted by a and the deposit on a less dense part by b. Also let x denote the amount of silver per unit area dissolved by the solution. Then the ratio of the two deposits, that is the contrast, will be a / b.

After the solution of the silver this becomes $\frac{a-x}{b-x}$, which is greater than $\frac{a}{b}$, the original ratio. If the reduction is carried so far that $b = x$, then the ratio becomes $\frac{a-b}{o} = \infty$; that is, the high lights will be white, while the shadows will equal the difference between the original densities. If the solution is allowed to act after this point is reached, of course no change can take place in the high lights; but the shadows will be continually decreased.

It may also be shown algebraically that the deeper the pictures are printed, the greater the contrast will be after the treatment.

Assuming that the ratio of the densities between any two parts of the print remains constant, any further printing would multiply a and b by the same quantity, say r. This assumption is not rigorously true, for it has been shown that a certain amount of light acting for a certain time on a sensitive surface will have a greater effect than half the light acting for twice the time; that is, the action on the sensitive surface does not vary directly as the amount of light.

It does practically, however, so that for our purposes the densities become ra and rb respectively, which by the action of the ferricyanide become $ra - x$ and $rb - x$, the ratio of the densities becoming $\frac{ra-x}{rb-x}$, which is greater, r being positive, than $\frac{a-x}{b-x}$.

However, since there is only a limited amount of silver salt in the paper, there can be but a certain amount of silver deposited; so that by very long printing the contrast is diminished, the high lights catching up, as it were, with the shadows.

If, in the ferricyanide solution, the nitric acid be omitted, the print may be left in the solution until it assumes the desired shade; and it will not be reduced any further in the fixing bath. The objections to omitting the acid are: The print is almost sure to be discolored, the grain of the paper is liable to show, the coating of the paper is sometimes eaten off in places, and it is more difficult to get the required contrast.

The action of the ferricyanide of potassium, without the nitric acid present, is to form with the silver a soluble double cyanide; but when the acid is present, it probably breaks this up, forming an insoluble cyanide, which afterward dissolves in the hypo. solution.

Either under or over exposed negatives can be made to yield quite presentable pictures by this method, and it would be of value wherever pictures with great contrasts are required, as for wood engravings.

Whether such prints are permanent, the writer has not had time to determine; but a few made a year ago show no change whatever, and in the opinion of the writer there is no reason why they should not be as permanent as ordinary prints, if not more so.

F. H. V.

The Latest Determination of the Sun's Distance.

An extensive series of observations was made in 1889 upon the planet Victoria (asteroid No. 12) for the purpose of ascertaining the distance of the sun, and incidentally also the mass of the moon—quantities which to the uninitiated would seem to bear no obvious relation to the motions of the little asteroid, though in fact the connection is close and positive.

The work was very thoroughgoing, involving the cooperation of no less than twenty-one different observatories in determining with their meridian circles the places of the stars which were used as reference points along the planet's track. Then all through the summer the position of the planet itself, with reference to these stars, was assiduously observed by Gill and Auwers at the Cape of Good Hope, by Elkin and Hall at New Haven, and in Germany by Hartwig at Gottingen and by Schur at Bamberg. The instruments employed in their observations were heliometers of the most perfect construction, and the measurements made with them rank among the most accurate and refined known in astronomy. Altogether, between June 15 and August 27, while the planet was near its opposition and for a time at a distance from the earth less than four-fifths the distance of the sun, over eight hundred complete sets of measures were secured, and only six nights were wholly missed.

The reduction of this mass of material has occupied nearly three years, and the result has only just been published. Dr. Gill, who originated the campaign and has reduced the observations, finds for the parallax of the sun 8·809", corresponding to a distance of 92,800,000 miles; and he further finds that the hitherto accepted mass of the moon must be reduced somewhat more than one per cent to satisfy the observations; in other words, the earth's monthly swing, due to her motion around the common center of gravity of earth and moon, was found to be about one per cent less than had been assumed. It is interesting to note that this newest value of the solar parallax agrees to the very last decimal with that deduced two years ago by Professor Harkness in his elaborate "least square" discussion of all the then available data relating to the constants of the solar system. The still outstanding error in our knowledge of the astronomical unit can hardly be as great as one part in a thousand.—*Prof. C. A. Young, in the Cosmopolitan.*

Fermentative Dyspepsia.

In nearly every case of functional dyspepsia that has come under my observation within the last ten months I have begun the treatment by giving five grains of bismuth subgallate, either before or after each meal. In some cases it seems to act more favorably when given before meals, and in others its action is better if taken after eating. In studying my records and memoranda of cases, I find that the treatment by salicin has often been unsatisfactory. The proportion of unsuccessful cases was about 25 per cent, but in some cases the effects of this remedy given alone have been remarkable. I have full records of one case of severe dyspepsia of ten years' standing that was completely relieved in a week without any return, now for more than a year. The bismuth subgallate, however, is almost a specific in cases of purely functional dyspepsia with flatulence.—*Dr. Austin Flint, N. Y. Medical Jour.*

Propagation of Fish.

The annual report of the New York State Commissioners of Fisheries says that last year the commissioners succeeded in distributing over 80,000,000 of the best varieties of fish in the waters of the State. This exceeds by 50 per cent the production of any previous year. The commissioners have given their greatest energies to the artificial propagation of shad, pike, perch, whitefish, tomcods, smelts, lake trout, frostfish and lobsters. Owing to the liberal stocking done by the commission, tomcods and smelts were never so abundant in the streams as they have been during the last two seasons, and immense catches have been made in Long Island Sound and its tributaries.

The Poison of Influenza.

The ptomaine extracted from the urine in cases of influenza is a white substance crystallizing in prismatic needles, soluble in water, and of a slightly alkaline reaction. It forms a hydrochlorate, a chloroplatinate, and a chloraurate, all crystalline. It gives a brownish precipitate with phosphotungstic acid, a yellowish with phosphomolybdic acid, a yellow with picric acid, and a red with tannic acid. The composition of this base is $C_5H_{11}NO_2$. It is poisonous, inducing a strong fever and death in eight hours. It is not met with in normal urine.

The Cocoanut Tree.

This palm does not grow spontaneously on Key West or on any of the other Florida islands, as the violent north winds which often prevail in winter reduce the temperature of southern Florida too low for this heat-loving tree, although when planted and cared for while young it grows to a moderate size on the keys, and sometimes bears fruit; otherwise the nuts which are cast upon those shores by the Gulf Stream would have produced plants that would gradually have covered them, for it is in this way that the cocoanut has been able gradually to spread over all the sandy coral shores of the tropics of the two worlds. The place of its first home is uncertain. It was believed by the younger Candolle to have first appeared on some of the islands of the Indian Archipelago, whence it was carried either by ocean currents or by man to the southern coast of Asia, east tropical Africa, and to the islands and shores of Pacific tropical America. Undoubtedly it was brought by man to the West Indies and Brazil after the discovery of America by Europeans, although it has now so spread, through the action of ocean currents or by the agency of man, that it has every appearance of being indigenous on the shores of east tropical America.

The cocoanut palm is a magnificent plant, well named "a prince of the vegetable kingdom," with tall, slender columnar stem eighty or a hundred feet high, and rich pale yellow-green leaves which are thirty or forty feet long, and flutter and rustle with every breath of wind.

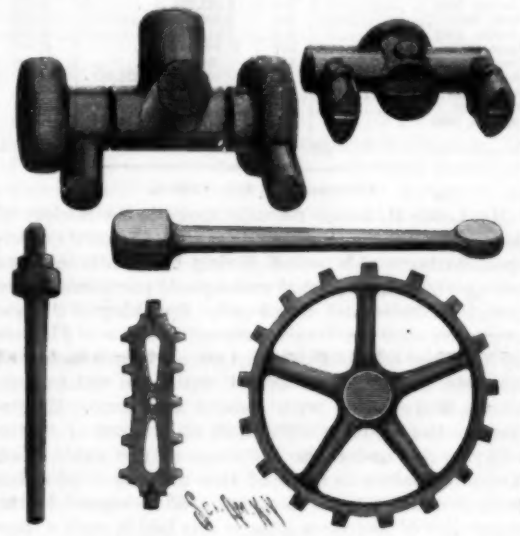
The cocoanut grows only near the shore, where its roots, penetrating the sandy soil, may drink freely from clear underground springs. Of all trees it is the most useful to man, furnishing food, shelter and employment to hundreds of thousands of the human race. In tropical countries, especially in southern India and Malaya, the cocoanut supplies to whole communities the chief necessities of life. Every part is useful; the roots are considered a remedy against fevers; from the trunk houses, boats and furniture are made; the leaves furnish the thatch for houses and the material from which baskets, hats, mats and innumerable other articles are made; the network of fibers at their base is used for sieves and is woven into cloth; from the young flower-stalks a palm wine, called toddy, is obtained, from which arrack, a fiery alcoholic drink, is distilled. The value of the fruit is well known. From the husk, which is called coir, commercially, cordage, bedding, mats, brushes and other articles are manufactured. In the tropics, lamps, drinking vessels and spoons are made from the hard shells. The albumen of the seed contains large quantities of oil, used in the East for cooking and in illuminating; in Europe and the United States it is often made into soap and candles, yielding, after the oil is extracted, a refuse valuable as food for cattle, or as a fertilizer. In some parts of the tropics the kernel of the seed forms the chief food of the inhabitants. The cool, milky fluid which fills the cavity of the fruit when the nut is young affords an agreeable beverage, and the albumen of the young nut, which is soft and jelly-like, is nutritious and of a delicate flavor.

As might be expected in the case of a plant of such value, it is often carefully and extensively cultivated in many countries, and numerous varieties, differing in the size, shape and quality of the fruit, are now known. The cocoanut is propagated by seeds; the nuts are sown in nursery beds, and at the end of six or eight months the seedlings are large enough to plant. The plants are usually set twenty-five feet apart each way in carefully prepared beds filled with rich surface soil. Once established, a plantation of cocoanuts requires little care beyond watering, which is necessary in its early years to insure a rapid and vigorous growth. In good soil the trees usually begin to flower at the end of five or six years, and may be expected to be in full bearing in from eight to twelve years. Thirty nuts from a tree is considered a fair average yield, although individual trees have been known to produce an average of three hundred nuts during a period of ten years. An application of manure increases the yield of the trees, although probably the value of the additional crop obtained in this way is hardly large enough to justify much expenditure.

In recent years the cocoanut has been cultivated on a very large scale in British Honduras, Jamaica and other parts of Central America, as well as on the northern coast of South America and the West Indies. The consumption of cocoanuts in the United States has become very large, as many as twenty millions being imported to this country every year. They are brought largely in steamers with other cargoes, although there are sailing vessels engaged in this trade exclusively, and last month two schooners discharged in this city, respectively, 170,000 and 260,000 nuts. Those which come from San Blas are considered the most desirable, since they shell more easily, while the meat is richer in oil and retains its flavor longer than others. Those from Baracoa are larger, but they lack oil and flavor, and cost less. After they are unloaded the nuts are sorted here and divided into three grades, according to size. The present price for select nuts from San Blas is $38.00 a thousand, from Jamaica $25.00, and from Baracoa $20.00, while the other grades are correspondingly lower; the lowest class, known to the trade as "eggs," brings only $10.00 a thousand. More than one-half of all the cocoanuts imported are bought by the confectioners, a single firm in New York using as many as forty thousand a month, and it is possible to fill this large standing order because importations are made all the year round. Of the remainder the larger portion goes to the desiccating establishments, while only a few are now sold in the stores in their natural condition.—*Garden and Forest.*

BICYCLE DROP FORGINGS AT THE CYCLE SHOW.

The production of drop forgings may be considered a distinctively modern development in metallurgy. Where a large number of pieces of identical shape have to be produced, such method becomes most available. The original dies are expensive, though their manufacture has been cheapened by utilization of the die-sinking machine, a tool which resembles a drill press, but which is provided with mechanism for feeding the die while it is being cut by a species of drill. In some cases a good deal of hand work is required to finish the die. For each forging operation a pair of dies are needed. One is mounted in the hammer head, the other on the anvil, and they are accurately adjusted so as to come together in the precise position required. Three classes of dies are used. The breaking-down dies are employed for the first attack upon the metal, to bring it to its approximate shape. These require special skill in their designing, the problems of approximating to the final shape being often very difficult. The finishing dies are the precise shape of the finished article with due allowance for shrinkage if required.



J. H. WILLIAMS & CO.'S BICYCLE DROP FORGINGS.

Finally, the trimming dies for removing surplus metal from the forgings may be applied.

It is not every forging which requires all three classes of dies. A single set may complete a simple shape. Where great accuracy is required, cold stamping is applied. This gives a finish to within 0·001 inch of the desired dimensions.

The testing of the finished dies before use is accomplished by pouring melted lead into their cavity, giving a casting which accurately represents the product they will give in steel.

At the recent bicycle exhibition held in this city, much attention was excited by the exhibit of drop forgings of the firm of J. H. Williams & Co., of Brooklyn, N. Y. This included a variety of bicycle parts aptly designated the "keystones of the wheel," so smoothly finished as to be almost ready for the nickel plater or enamel oven.

Some typical forms are shown in the accompanying cut. The sprocket wheel, pedal pin, pedal foot plate, crank arm, crank bracket, and front fork crown are shown. As they leave the dies, the pieces are almost perfect. On the round pieces, such as the pedal pin, no fin exists. A little polishing, boring out, turning and threading in places, completes these articles. It is clear that the day of castings in bicycles is gone forever.

Rustless Coating for Iron, Tinning and Enameling.

The following is a translation given in the *Journal of the Society of Arts*, by Mr. Frederic W. North, of a paper read before the Paris Societe d'Encouragement by M. Octave de Rochefort-Lucay, on the new Bertrand processes for coating with magnetic oxide and enameling iron and iron carburets, and on a new process of tinning for cast iron.

Messrs. Barff and Bower were the first to practically coat iron, steel, and cast iron with magnetic oxide, so as to form, at the cost of the metal itself, the protective layer that is obtained usually from paint, or from enameling, etc., with a thin coating of a metal that is not oxidizable.

The Bertrand processes are more simple than those of Bower and Barff, and are based on a new discovery in chemistry, and may be stated thus: If a thin adherent film of another metal is formed on the wrought iron or on the cast iron, and this iron or cast iron, heated to 1,000°, is exposed to a current of oxidizing gas, the oxygen penetrates through the film, oxidizes the iron or the cast iron, and under these conditions, magnetic oxide is the result. The formation of magnetic oxide, thus obtained, continues indefinitely, and the thickness of the coating of oxide increases according to the period of exposure to the oxidizing current, provided the temperature remains at about 1,000°.

As to the film of metal deposited in the first instance, it disappears in some obscure way, forming oxides which mingle with the magnetic oxide or volatilize according to the nature of the metal of which they are composed. M. Bertrand had then to find the best metal and the best method for depositing it on the article to be coated, and he has found that bronze, a mixture of copper and tin, gives, from a practical point of view, every satisfaction. For depositing this bronze on the wrought iron and cast iron, M. Bertrand uses electricity or wet baths, and uses sulphophenolic acid.

The following is the method adopted in the Bertrand manufactory for an oxidation: The article is cleansed (the cleansing is not indispensable), then dipped a few moments in a bath containing a solution of sulphophenate of copper and tin. The coating of bronze being formed, the article is immediately washed with cold water and dried with sawdust. The article dried is put into a furnace. Oxide forms, and at the end of fifteen to thirty minutes (according to the articles) the article is taken out, sufficiently oxidized. The coating produced varies from $\frac{1}{10}$ to $\frac{1}{2}$ of a millimeter.

M. Bertrand uses electricity to ascertain if the coating is of sufficient and uniform thickness, and in doing so he makes use of bells. If in putting the two wires in contact with the oxidized article the bells ring, the current passes—the oxidation is insufficient; if it remains silent, the oxide formed is of sufficient practical thickness, because it prevents the electric current from passing.

Process for Tinning Cast Iron.—M. Bertrand has also used sulphophenolic acid to obtain tinning on iron. He dissolves salts of tin in a mixture of water and sulphophenolic acid at the rate of 1 per cent of tin salt and 5 per cent of sulphophenolic acid. In this mixture the article, which is previously cleaned, is dipped; and is at once covered with an adherent coating of tin, and afterward by the means of rotating brushes in wire and cloth, the coating of tin is polished, and a result obtained which is both effective and cheap.

Process for Enameling.—There are not more than two processes for enameling cast iron. In the first, called hot, the iron, heated to a vivid red, is powdered with a flux powder (borosilicate of lead), distributed with a sieve, then it is heated, and when the flux fuses, it is powdered afresh with glass more soluble, forming the glaze of the enamel. This process, the only direct enameling, is dangerous to the operator, and even impossible for large articles, nor does it allow of decorations. The second process consists of dressing the cast iron either by three distinct and successive operations in the furnace with a kind of pottery. In the Bertrand enameling, the article is first coated with magnetic oxide, then dipped in borosilicates of lead, colored by metallic oxides, in which is added a little pipe-clay in order to give rather more body. The article thus covered cold, by dipping or with brushes, is put into the furnace; the enamel adheres and vitrifies at the usual furnace temperatures used by enamelers. By putting a coating of colored enamel with a brush on a first coat simply plain, it is possible to make any decorations desired, which may be burnt in at one operation for outdoor vases, etc. These results, due to the first oxidation with magnetic oxide, are remarkable, as much for the color as for the tenacity of the enamel and its resistance to rough usage.

Chemical Method of Engraving on Wood.

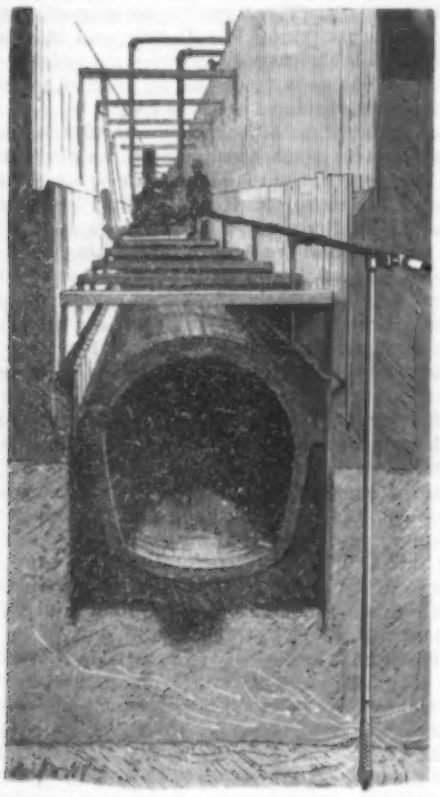
M. Delaurier, in the course of his business, employed wooden agitators to dissolve the bichromate of potash or other salts, which he put into a mixture of sulphuric acid and water. These agitators gradually dissolved, without being carbonized, as would be the case with sulphuric acid alone, especially if at all concentrated; and without softening, either, as with nitric acid. M. Delaurier has not endeavored to ascertain why this should be so, although he has no doubt that the investigation would be of scientific importance and of interest to trade, but he suggests that his observation be utilized for a method of engraving on wood, the block being coated with a resist varnish, the design being drawn in with a point as when engraving on metal, then to etch away the wood by immersion in the following mixture:

Sulphuric acid	4 parts.
Soda bichromate	1 part.
Water	6 parts.

M. Delaurier made the experiment with perfect success.—*British Lithographer.*

IMPROVED METHOD OF CONTROLLING QUICKSAND.

This improvement relates to the construction of sewers, water pits, foundations below the water level, and other excavations where layers of quicksand or equivalent material are liable to be encountered, permitting mason work to be built on dry bottoms. It may also be used to exhaust ground water from large areas, thus obviating the necessity for an under-drain in the construction of sewers, and materially lessening their cost. This improvement has been patented by Mr. Calvin Horton, of No. 26 Everett Avenue, Somerville, Mass. Our illustration shows the employment of this improved method in the building of a sewer, where the trench has been dug through a stratum of clay overlying a stratum of silt or quicksand, beneath which is coarse gravel, from which water may come under sufficient pressure to cause the quicksand to boil upwardly into the trench. To prevent this a series of driven wells is located in the line of the trench, their upper ends connected by pipes and couplings with a pump receiving the water through a sand box. In practice these wells have been placed about eight feet apart, and eight or ten of them connected to one pump, but this necessarily varies with the flow of water and the nature of the ground. When the wells are driven so that their lower ends are in the quicksand, the ends are provided with jacket strainers. This invention was made in remedying the difficulty found in the construction of the new system of sewerage of the city of Boston. It was found that with this method, after pumping a few hours, the boiling springs of quicksand, which had been very troublesome, entirely ceased, and the sand remaining in the trench was solidified so that it could be readily shoveled out. It was also found that, in excavating directly from the quicksand, the removal of water so quieted and solidified the quicksand that it could be freely handled with a shovel.



HORTON'S METHOD OF CONTROLLING QUICKSAND.

How to Recognize Horse Flesh.

The method is based on the use of the well known iodine reaction of glycogen, a body which is a constant constituent of horseflesh. The finely divided flesh is boiled with four times its weight of water, and the resulting broth treated with dilute nitric acid, to precipitate albuminoids, and filtered. Saturated hydriodic acid is then added, so that the two liquids remain in distinct layers, and at their plane of contact a red or violet ring forms should glycogen be present. In the event of extraction of the glycogen with water proving inadequate, a solution of caustic potash containing an amount of KOH equal to three per cent of the weight of the flesh must be substituted.

The reaction is said to be characteristic, as it is not yielded by the flesh of other domestic animals.—*W. Brautigam and Edelmann, Pharm. C. H., 1893, xxiv. 557, through Chem. Zeit.*

CHICAGO CABLE CARS ON CHICAGO DAY.

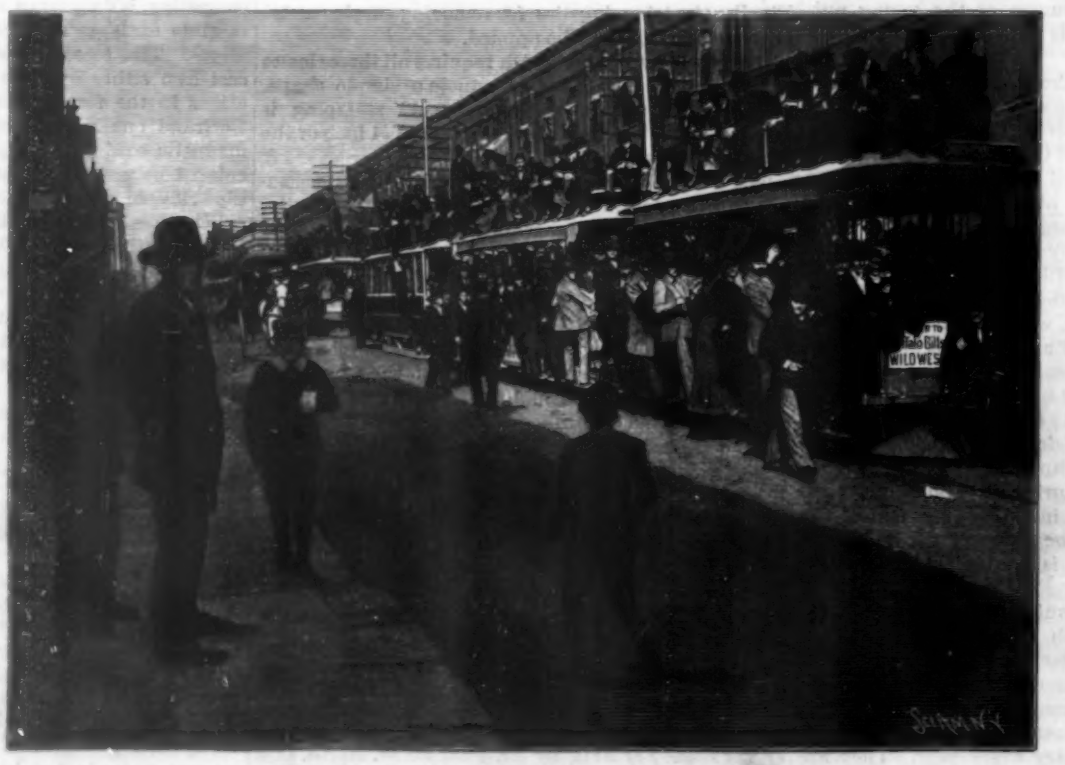
A correspondent doing business on Cottage Grove Avenue, Chicago, has favored us with some interesting photographs taken on Chicago day, October 9. One of these views we reproduce for the benefit of our readers. The people who were fortunate enough to get in or on the Wabash and Cottage Grove Avenues cable cars made a slow and painful trip to the Fair grounds. Business was never more thoroughly suspended throughout the city than on that day. The weather was perfect, and when the gates of the Exposition grounds were opened at six in the morning the people stood in lines waiting to enter, and the procession of visitors never ceased until late at night. Every kind of conveyance was put into requisition and the combined effort was inadequate to cope with the enormous crowds. There were 716,000 paid admissions and 37,380 persons entered on passes, so that Chicago holds the record for the largest number of visitors on one day.

The following table shows the attendance at the principal international exhibitions:

	Number of days open.	Total attendance.	Highest number in one day.	Average daily attendance.
London, 1851	144	6,039,195	....	41,939
Paris, 1855	200	5,162,330	.....	25,812
London, 1862	171	6,211,103	.....	36,322
Paris, 1867	217	10,300,000	.....	47,000
Vienna, 1873	186	7,254,687	....	39,003
Philadelphia, 1876	159	10,000,000	274,919	62,892
Paris, 1878	194	16,159,719	200,613	83,297
Paris, 1889	164	32,354,111	387,877	192,391
Chicago, 1893	188	27,377,732	716,881	149,605

Pavements for Cities.

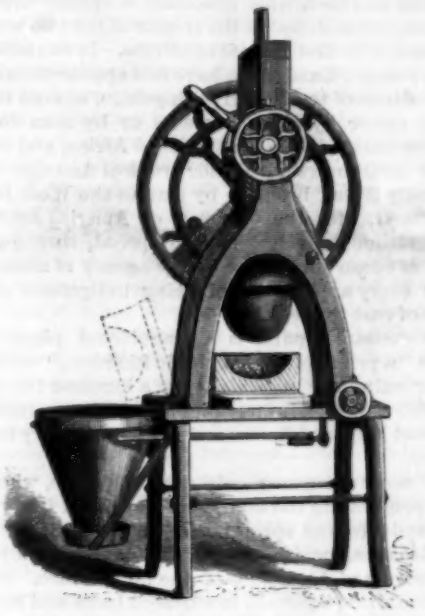
Mr. Lewis H. Isaacs recently spoke to the Society of Arts of paving work in London, after 35 years' experience, during which period paving by granite sets has been perfected, and wood and asphalt pavements have been introduced and developed. Speaking of the use of granite sets, Mr. Isaacs declares in favor of 9 inches by 3 inches sets laid close up on at least 9 inches of concrete, barreled 1 in 40, well channeled with smooth blocks, and grouted with cement and sand. He disparages the grouting with pitch, on account of its liability to give under the influence of the sun's heat. The only feature in favor of this method of grouting is its imperviousness to water. With regard to the durability of Aberdeen granite sets laid in such a thoroughfare as High Holborn, and relaid twice in twenty years, it appears that such cubes will last 36 years, with a total vertical wear of 4 inches, and still remain fit for paving second or third class streets. Wood pavement costs, in the long run, half as much again as granite sets, but it is increasing in vogue by reason of its comparative noiselessness and easy traction. On the other hand, it is hygienically the least defensible. Asphalt is the costliest pavement of all, but it is one of the most durable, and is the cleanest.



CHICAGO CABLE CARS ON CHICAGO DAY.

AN EFFICIENT PULVERIZING MACHINE.

This machine is adapted for operation either by hand or power. It has a movable screen and funnel to screen the crushed material, and the mortar is so arranged that it may be readily tipped to deposit its load on the screen. The improvement has been patented by Mr. John H. Traver, of Aspen, Col. The mortar is carried on a sliding base, hinged to a slide, enabling it to be pushed forward to the front portion of the machine and dumped, as shown in dotted lines.



TRAVER'S PULVERIZING MACHINE.

The pestle is carried by a vertical shaft, turned by a bevel gear wheel, the set screw of which is held in a longitudinal keyway in the shaft, so that the shaft may slide through the gear when the pestle is raised. The driving shaft has at its outer end a balance wheel with a crank, to be turned by hand, and a rim wheel to which a belt may be applied. A vertical lever fulcrumed at the back of the machine is held at its upper end by a spring in the path of a boss on the shaft, and the lower end of the lever is connected by a link with a shaker arm connected with the funnel, in the upper end of which is a screen, whereby both the funnel and screen will be shaken by the rotation of the driving shaft. When it is not necessary to use the shaker, the operating lever may be held away from the driving shaft by a cam on a short shaft, having at its outer end a hand wheel. Above the driving shaft is a shaft on which is an arm extending beneath a collar on the pestle shaft, and by means of a hand wheel or lever the arm may be turned upward to lift the pestle from the mortar. The lever may be operated to raise the pestle only slightly, or to raise it completely and hold it locked in elevated position.

Coating Aluminum with Other Metals.

Before the Physical Society, Berlin, Prof. Neesen recently demonstrated a method of coating aluminum with other metals. This consists in dipping the aluminum in a solution of caustic potash or soda, or of hydrochloric acid, until bubbles of gas make their appearance on its surface, whereupon it is dipped into a solution of corrosive sublimate to amalgamate its surface. After a second dipping into caustic potash until bubbles of gas are evolved, the metal is placed in a solution of a salt of the desired metal. A film of the latter is rapidly formed, and is so firmly adherent that, in the case of silver, gold, or copper, the plate can be rolled out or polished. When coating with gold or copper, it is well to first apply a layer of silver. When thus treated the aluminum may be soldered with ordinary zinc solder.

THE French are great believers in the utility of swift torpedo boats, of which 101 have been ordered; some of them are already complete, 53 of them have 23 knots speed, and 25 of them increased speed up to 28 knots.

ELECTRIC WELDING OF RAILS IN PLACE.

We have already pointed out to our readers, at the time of its advent, the process of electric welding invented by Professor Elihu Thomson, of Lynn, Mass., as well as the apparatus presented by the Thomson Electric Welding Company, at the Exposition of 1889. Since that epoch, great progress has been made, as well as many applications that it would be impossible to give a complete enumeration of. Simple welding has given place to a complete system that truly merits the much more general and accurate name of the electric working of metals, and of which we are going to try to give a description, in putting to profit the data that have been kindly furnished us by Mr. Hermann Lemp, electrician of the company, during our recent visit to the works at Lynn, near Boston.

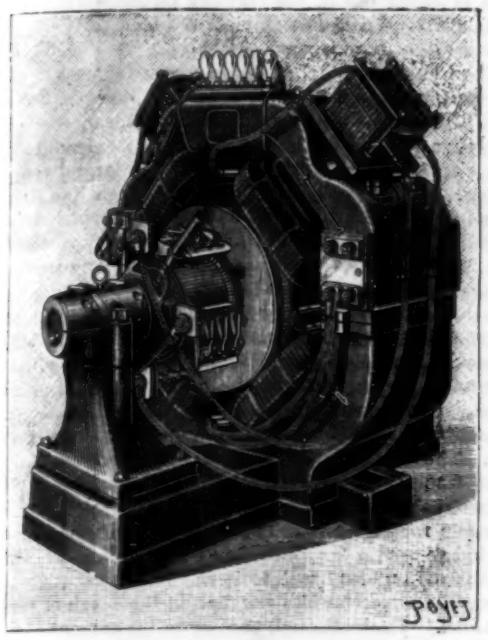


Fig. 1.—REVOLVING TRANSFORMER SEEN AT THE SIDE AT WHICH THE CONTINUOUS CURRENT ENTERS.

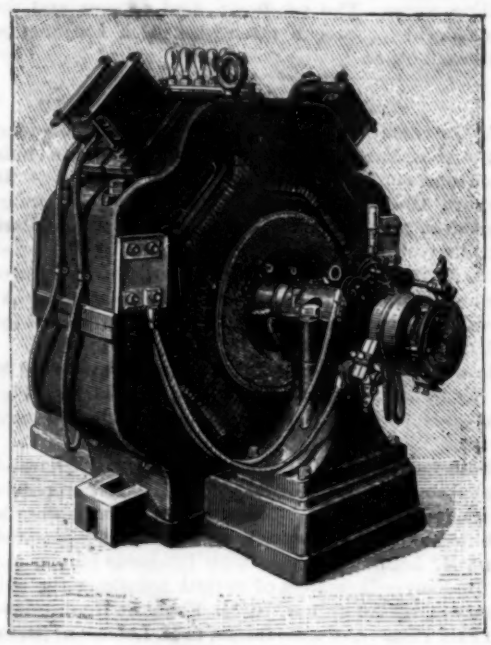


Fig. 2.—THE SAME SEEN AT THE SIDE FROM WHICH THE ALTERNATING CURRENTS START.

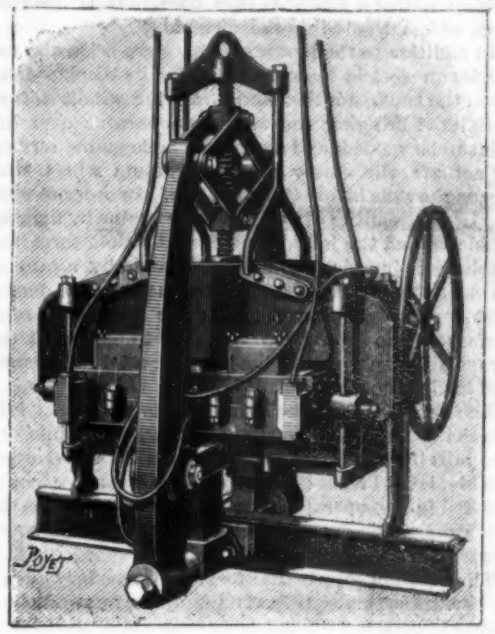


Fig. 3.—WELDING TRANSFORMER.

We shall be content to recall the general principle of the process of electric heating employed in all cases. It consists in sending through the pieces to be heated an intense current generated by the secondary circuit of a transformer whose primary is supplied by an alternating current derived either from an alternator actuated directly by a steam or hydraulic motor or (as we have previously had an example of it apropos of the welding of rails) from a continuous current which, traversing a rotary transformer or dynamo motor, is directly converted into an alternating current.

All the alternators applied by the Thomson Electric Welding Company to the electric working of metals, and the power of which varies at *present* between 1 and 80 kilowatts, operate at a normal potential of 300 volts and at a frequency of 50 periods per second. The intensity of the primary current is made to vary according to the bulk of the pieces to be welded by interposing in the secondary circuit a *reaction bobbin* that plays practically the same role as a resistance, without, however, occasioning the same waste of energy, and that, for this reason, is much superior to a simple resistance.

Seeing the power of production of the machines for working metals electrically, it is possible in certain cases to utilize such machines in the working of metals only during the day, and, at night, to employ the dynamos and motors that effect the lighting of the works, through the aid of special transformers calculated for utilizing the primary potential of 300 volts. The expenses of installation are thus greatly reduced. The section of the welded pieces is daily increasing with the power of the machines and the exigencies of the industries. It reaches and exceeds to-day, with iron or steel, 23 square inches.

Among the operations daily performed by the varied machines turned out by the works under consideration may be mentioned the automatic manufacture of ordinary chains, the iron rod entering at one end of the machine and making its exit entirely finished at the other end at the rate of 245 feet per day's work, and the direct welding of twisted cables, wire by wire, in a single operation, etc. But we shall dwell more particularly at present upon the most original and curious of the operations effected by Prof. Elihu Thomson's processes of electric welding. We refer to the welding of rails in place with a view to obtaining a solid and continuous track. It is very evident that a continuous track formed, for each rolling table, of a single jointless rail would be the ideal from the standpoint of the stability of the track, of traction, of speed and of the comfort of travelers; but two impossibilities present themselves, one relative to the manufacture and laying of such a rail and the other relative to expansion. As regards electric traction, the single rail would offer one advantage more, that of forming an excellent return conductor—a result that has been only imperfectly obtained up to the present by means of complicated arrangements, a description of which would not come within our province.

The Johnson Company, of Pennsylvania, a powerful corporation whose specialty is the construction of railway and tramway *materiel*, thought that, being taken into consideration the special conditions in which the tracks of tramways are established, being generally embedded and fixed in the roadbed, the variations in the temperature of the rail through extreme seasons ought to be less than in the more exposed rails of railways, and that, under such circumstances, the effects due to expansion ought to be null or practically negligible, or slight enough at all events to permit of a complete junction of the rails.

In order to throw a definite light upon the question, it constructed between March 19 and April 25, 1892, an experimental track 1,100 feet in length formed of rails firmly connected with each other by fish plates so as to practically form a single rail, and the variations from March to the end of August were carefully noted, as were also the effects produced. All the details of this important experiment are embodied in a communication made by Mr. J. A. Moxham, president of the Johnson Company, to the American Street Railway Association at its meeting held at Cleveland in October, 1892.

The experiment was decisive, and demonstrated that between an external temperature of 10° F. and 121 F. no motion of the track occurred. To Mr. Moxham the effects of expansion showed themselves simply by an extension or a slight compression, a feeble diminution or a feeble increase of the section of the rail. In calculating the stresses exerted by the variations of temperature upon the rail laid at an intermediate temperature, we find that not only do such stresses remain much inferior to the limit of elasticity of the material, but also that they are inferior to those accepted in practice for the construction of bridges and framework. We can, then, the question of difficulty of construction set aside, employ a continuous rail, under certain reserves relative to construction and laying, and make use of rails firmly united, and particularly of rails welded electrically *in situ*.

After the conclusive experiments made by the Johnson Company, it was decided to apply the process to a tramway line that had been laid for two years by the West End Street Railway between Boston and Cambridge. The *materiel* necessary for the operation was ordered last year from the Thomson Electric Welding Company. The first experimental welding was done with this *materiel* on the first of February, 1893, upon a foot rail of the Johnson type 9 inches in height. The section of the joint was 25 square inches, and the welding took an electric power of 150 kilowatts, furnished by the continuous current actuating the tramway from Lynn to Boston. It was this *materiel* that was utilized at first at Johnstown upon an experimental track of 3,000 feet, and then at Cambridge, upon a length of nearly two miles. Fig. 4 gives a general view of the special car devised for the welding of rails *in situ*. The box of the car contains the *materiel* necessary for the production of the alternating current and the regulation of it. The front is reserved for the welding apparatus.

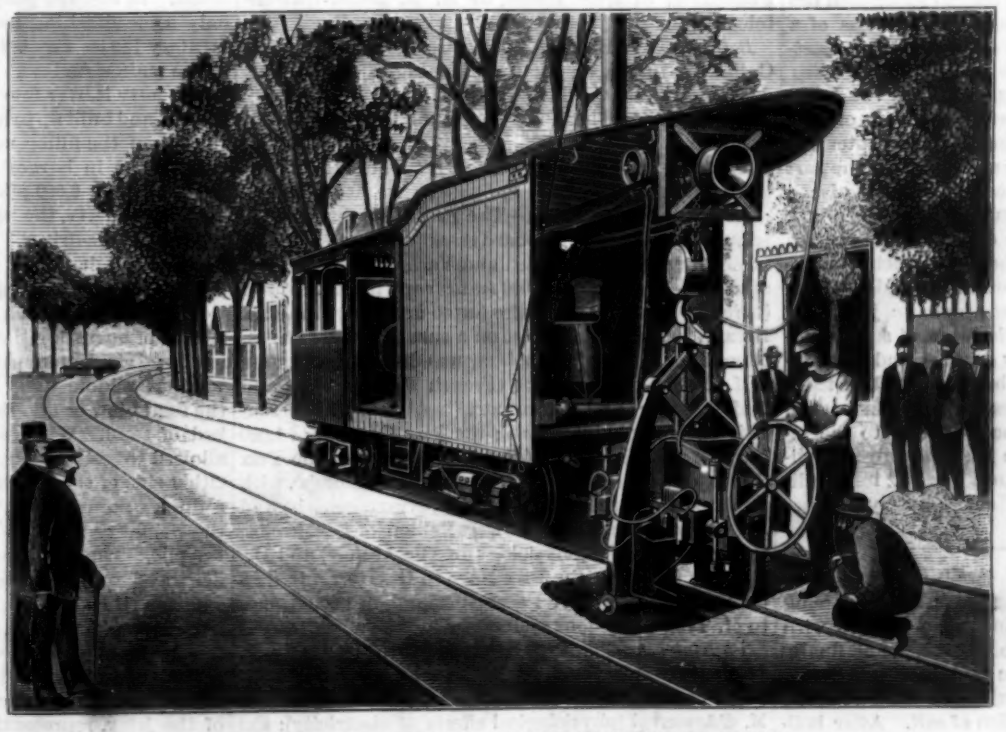


Fig. 4.—CAR FOR WELDING TRAMWAY RAILS IN PLACE

The alternating current is produced by the transformation of the 500 volt continuous current led from the central works through the aerial wire by means of an ordinary trolley and a special trolley put in communication with the wire of the return line in order to increase the section of the conductor. The current enters a rotary transformer, a four-pole dynamometer, which, receiving a continuous current through the brushes, furnishes an alternating current upon two collecting rings arranged upon the other extremity of the shaft.

Figs. 1 and 2 represent this transformer seen from the side at which the continuous current enters and at

the side from which the alternating current starts. There is thus obtained directly an alternating current of 300 effective volts, which, in the transformer, will furnish about 4 volts and 40,000 amperes. We say about, for one may conceive the impossibility of measuring so intense currents upon so short circuits. We can only estimate their value from the intensity of the primary current and the coefficient of transformation of the welding apparatus. The intensity of the primary current is regulated by means of a self-induction bobbin interposed in the circuit. To this effect, the bobbin carries a movable iron core that is inserted more or less deeply into the solenoid.

In addition to the motor and its accessories, the car carries an electric motor serving for its displacement upon the track, another actuating the windlass that permits of bringing the welding apparatus over the joint to be welded, and a small movable motor serving to actuate the emery or carborundum wheel that cleans the rails before the operation. In order to weld the two extremities of the rails, one begins by digging a hole around the joint, the fish plates that form the mechanical junction are unbolted, and, by means of an emery wheel set in action by a small electric motor that receives its current from the line, the lateral surfaces of the two rails to which are to be welded the two small straps forming the joint are carefully cleaned and made true.

The straps have a special form. They are bent into the shape of a U with very short arms. The union of two rails by means of two of these U's arranged upon the two lateral faces between the head and the foot is effected in two operations, the first of which welds the two straps upon one of the rails and the second welds the two straps upon the other rail.

The plates of copper that form the secondary circuit of the transformer (Fig. 3) terminate in two hollow blocks of copper with flat faces that apply themselves against the two straps to be welded, and thus close the circuit through the mass of the extremity of the rail. A rapid current of water circulates in the blocks of copper, in order to prevent them from becoming heated. When, after two or three minutes, the temperature of the part interposed in the circuit of the transformer has reached the welding point, a strong pressure is exerted upon the joint by means of a hand wheel with horizontal spindle, which, through the intermedium of a gearing, revolves a screw with vertical axis that brings together the two vertical summits of a jointed lozenge and separates the two horizontal extremities connected with the tightening clamp. These transmissions as a whole permit one man, without stress, to exert a total force of from fifteen to twenty tons upon the joint, and to thus obtain, through compression of the metal, a perfect welding. When the welding is finished, the jaws are unlocked by means of the hand wheel and the welding apparatus is removed by means of the electric windlass and carried to another joint.

While the joint is still red it is easy to straighten the rails and place them in the alignment by means of a few blows of a hammer properly applied to the projecting parts.

Such, as a whole, is the process applied by the Johnson Company to the welding *in situ* of the rails of electric tramways. At the beginning of last September we had an opportunity of seeing at Cambridge the part of the track welded by this process. It is distinguished from the non-welded track by an easier rolling of the cars, and, on inspection, by the difficulty experienced in seeing *in situ* the joints of the rails, which, well assembled and perfectly smooth, form true hidden joints. It would be rash to desire to pass a definite judgment upon the industrial and economic value of such welding, which, in any event, is very original and very interesting, before an entire year has passed. If, as there is every reason to hope, the results prove favorable, the welding of rails will give a new impulse to the industrial development of electric tramways, by simplifying the construction of the return line and in permitting of the use of lighter and consequently cheaper rails.—*La Nature.*

Purification of Resin.

One process consists of melting the resin and passing through it a current of chlorine gas, acidifying with sulphuric acid, washing with boiling water, and finally with hot water containing nitric acid.

Another process consists of melting and then boiling the resin with a saturated solution of salt. After boiling for some minutes in a solution of chromic acid or a solution of bichromate of potash with twice its weight of sulphuric acid, it is washed with a slightly ammoniacal water.

Another method consists in heating the resin with a mixture of chalk, dioxide of manganese and potassium bichromate and filtering through sand. Heating with powdered zinc, with or without sodium bisulphate, has also been suggested. Sulphuric acid and zinc chloride at high temperatures have also been tried.

Seemingly the best process consists of first filtering to separate insoluble matters and dirt, then heating to about 150° C. with 5 per cent of zinc chloride for an hour or two, and then adding 12 per cent of bichrome in the form of a powder. After sufficient heating, the mass is allowed to cool down to 100° C. and is filtered. Lastly we have to mention purification by anhydrous sulphuric acid with heat under pressure, in a sheet iron caldron which can be heated by superheated steam and fitted with a cover capable of resisting a pressure of 5 kilos. to the cubic centimeter.

In this 100 kilos. of the resin to be purified are placed, heated to fusion, the pressure raised to 4 kilos., and the sulphuric acid added. The whole is heated to 100° C. for an hour, when it is left to cool, and washed with boiling water. The sulphuric acid process and the zinc chloride process are often worked in conjunction with each other.

Science Prizes.

At the recent annual public meeting of the Academy of Sciences, Paris, M. De Lacaze-Duthiers in the chair, after some commemorative words on the deaths of Sir Richard Owen, Kummer, and De Candolle, foreign associates, and those of Chambrelent, Admiral Paris and Charcot, members of the academy, by the president, M. Bertrand, one of the secretaries, announced the names of those to whom prizes had been awarded. It will be seen that American scientists were not forgotten.

In *Geometry*, the Prix Francœur was awarded to M. G. Robin for mathematical physics, and the Prix Poncelet to M. G. Koenigs, for geometrical and mechanical work.

Mechanics.—The extraordinary prize of 6,000 francs offered by the Departement de la Marine for contrivances increasing the efficiency of the navy, was distributed among M. Bourdelles (for lighthouse illumination), M. Lephay (compass with luminous index), and M. De Fraysseix (system of optical pointing); the Prix Montyon, of 700 francs, to M. Flamant (hydraulics); the Prix Plumey, of 2,500 francs, to M. Lebasteur (steam engine appliances); the Prix Fourneyron, of 500 francs, to M. Brousset (fly wheels).

Astronomy.—The Prix Lalande, of 540 francs, to M. Schulhof (comets); the Prix Valz, of 460 francs, to N. Berberich (minor planets); the Prix Janssen, of a gold medal, to Mr. Samuel Langley (astronomical physics).

Physics.—The Prix La Caze, of 10,000 francs, to M. E. H. Amagat (gases and liquids).

Statistics.—The Prix Montyon, of 500 francs, to Dr. Marvand (diseases of soldiers).

Chemistry.—The Prix Jecker, of 10,000 francs, to M. D. Forcrand and M. Griuer in equal parts, with a special prize to M. Gautier; the Prix La Caze, of 10,000 francs, to M. Lemoine (phosphorus compounds).

Mineralogy and Geology.—The Grand Prix to M. Marcellin Boule (the central plateau of France); the Prix Bordin, of 3,000 francs, was distributed among MM. Bourgeois, Gorgen, Michel, and Duboin for their researches in mineral synthesis; the Prix Delesse, of 1,400 francs, to M. Fayol (Commentry strata); the Prix Fontannes, of 2,000 francs, to M. R. Zeiller (paleontology).

Botany.—The Prix Desmazieres, of 1,600 francs, to M. C. Sauvageau (algæ); the Prix Montagne to MM. Cardot (mosses) and Gaillard (fungi).

Agriculture.—The Prix Morogues to M. Millardet (mildew).

Anatomy and Zoology.—The Prix Thore to M. Corbiere (muscinea).

Medicine and Surgery.—The Prix Montyon was distributed among MM. Huchard (heart diseases), Delorme (army surgery), and Pinard and Varnier (pathological atlas); the Prix Barbier, 500 francs each to MM. Sanson (heredity) and Dr. Mauclaire (osteo-arthritis); the Prix Breant, being the interest on a sum of 100,000 francs, offered for a cure for cholera, was distributed among MM. Netter and Thoinot (French cholera, 1892) and MM. Grimbert and Burlureaux (treatment of tuberculosis by creosote injections); the Prix Godard, of 1,000 francs, to Dr. Tourneux (physiological atlas); the Prix Serres, of 7,500 francs, to M. Pizon (blastogenesis), with small portions to MM. Sabatier (spermatogenesis) and Letulle (inflammation); the Prix Bellion, of 1,400 francs, to Dr. C. Chabrie (physiology of the kidney) and Dr. Coustan (fatigue); the Prix Mege to Dr. Herrgott (history of obstetrics); the Prix Lallemand, of 1,800 francs, to M. Trolard (venous system).

Physiology.—The Prix Montyon, of 750 francs, to M. Laulanie (respiration) and MM. Abelous and Langlois (renal capsules); the Prix La Caze, of 10,000 francs, to M. d'Arsonval (physiological effects of electricity); the Prix Pourat to M. E. Meyer (renal secretion); the Prix Martin-Damourette, of 1,400 francs, to Dr. Geraud (albuminuria).

General Prizes.—The Arago Medal to Mr. Asaph Hall (satellites of Mars) and Mr. E. E. Barnard (Jupiter's first satellite); the Prix Montyon, for improvements in unhealthy industries, was divided between MM. Garros (porcelain manufacture) and Coquillon (fire damp meter); the Prix Tremont, of 1,100 francs, to M. Jules Morin for his useful hydrostatic and other inventions; the Prix Gegner, of 4,000 francs, to M. Serret; the Prix Petit d'Ormoz, of 10,000 francs, to M. Stieltjes (mathematics), and another of the same amount to M. Marcel Bertrand (physics of the globe); the Prix Tchihatchef, of 10,000 francs, to M. Gregoire Groum-Grschimailo (the Pamirs); the Prix Gaston Plante, of 3,000 francs, to M. Blondlot (electric interference); Mme. De Laplace's Prize, consisting of Laplace's works, to M. Bes de Berc, of the Ecole Nationale des Mines.

The Longest Jetty in the World.

At the mouth of the Columbia River the United States government is building what will be the longest jetty ever constructed. It will also enjoy the distinction of being one of the very few public works whose ultimate total cost falls far short of the original estimates.

The Columbia is by far the largest river west of the Rockies, being considerably over 1,000 miles in length and for 100 miles from its mouth navigable for the largest ocean vessels. At its mouth, too, is a splendid harbor, capable of sheltering in safety the largest vessels afloat. It is the only safe harbor between San Francisco, 600 miles to the south, and the Straits of Juan de Fuca, 200 miles to the north. However, prior to 1885, the harbor was of little use, because of the shifting sands that opposed a bar first to one side and then to the other, and all the way from Cape Disappointment on the north to Point Adams on the south. The United States government, recognizing the value of this harbor to our commerce, both present and future, sent her most competent engineers to survey the harbor and present a plan to form a permanent deep water channel. The plans that were finally adopted were for a jetty from Point Adams out into seething waters for between four and five miles, to be constructed of basaltic rock or lava. This, it was predicted, would entirely close up the south channel or Tillamook chute and present a firm break to catch the sands that would otherwise form the shifting bar in the north or main channel. That effected, the powerful current of the vast body of water which the Columbia pours into the Pacific would keep open a natural and perfect gateway into the harbor. The jetty is now practically completed and the engineers' predictions fully realized. On the south side of the jetty, where formerly there was water from six to twenty feet in depth, is now over 4,000 acres of dry land, formed by the wash of the sea, while the largest ocean vessels sail without aid through the main channel and anchor in the harbor one mile further inland, within cable length of the shore.

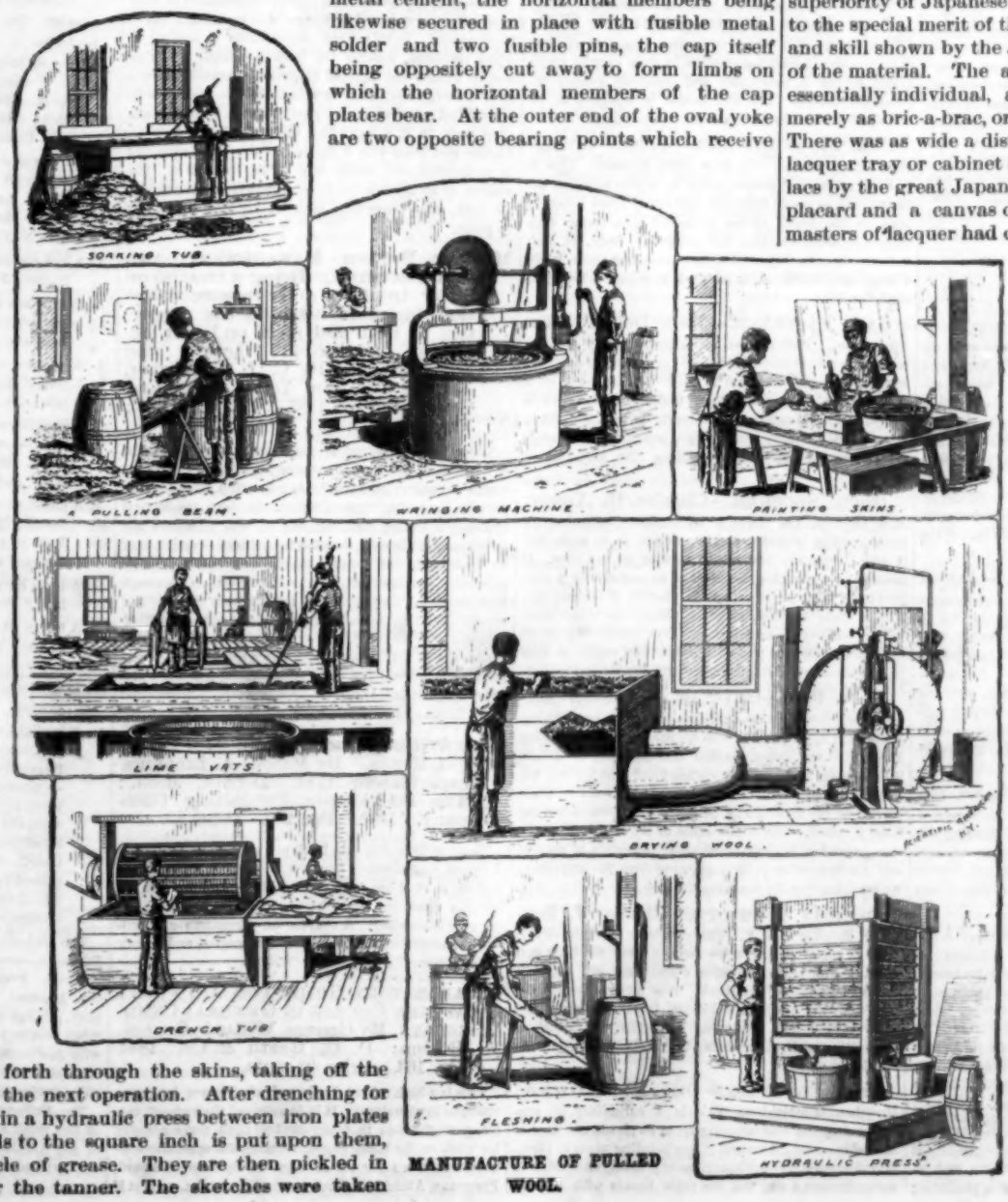
But the surprising part of the building of the jetty, and that which reflects great credit upon the engineers in charge, is that while the construction is pronounced first class throughout and every way up to the specifications, the total cost will fall short of the original estimates by more than $1,500,000. Careful and intelligent computations made in 1882–1884 placed the necessary total cost at $3,710,000. Thus far the requisitions have amounted to but $1,687,000, while less than half a million dollars more will pay for every bill on its account. In fact the jetty itself is completed, receiving only some finishing touches, but two smaller supplementary jetties are being added to perfect the action of the main structure.

The jetty is over four miles long, fifteen feet wide at the top, and built up to high water mark. The lava blocks that form the filling were quarried near Portland and transported in barges and by rail to the point where needed. Over 6,000 piles were driven in the space covered by the jetty, the piles being forced down by a huge hydraulic pile-driver. This powerful driver, with its 6,000 pound hammer, rests upon a tramway and is moved forward as required, while the entire framework revolving upon a wheel, whose radius is 31½ feet, admits of operating the machine through a corresponding large circumference. The huge hammer, however, was but seldom used in driving a pile, except to give the final blow or two that "set" the long timber in its bed of sand. When sinking a pile, the hammer was allowed to rest on its head. Two 2½ inch iron pipes on either side of the pile sent streams of water, forced by a duplex power pump, to open the sand beneath, and the weight of the hammer alone was sufficient to settle the pile. The construction has been done entirely under the charge of United States Engineers Powell and Thomas H. Handbury, the latter having been in charge since 1888. None of the work was let out by contract; day labor at eight hours for a day's work, under the direct supervision of the government officers, has accomplished the satisfactory results obtained. A model of the jetty, representing 400 feet of its length, was exhibited in the Government building at the World's Fair, and attracted the favorable comments of both home and foreign engineers who inspected it.—*American Contractor.*

As a specimen of typography the Christmas number of the *Northwestern Miller* is unusually fine. The cover is printed in colors, showing an artistic picture. There are over sixty pages of elegantly printed reading matter, and nearly two hundred admirable photographic illustrations. The literary contents embrace an interesting account of the visit of the Millers' Association to Europe; then there are stories and practical information, entertaining and valuable.

WOOL PULLING.

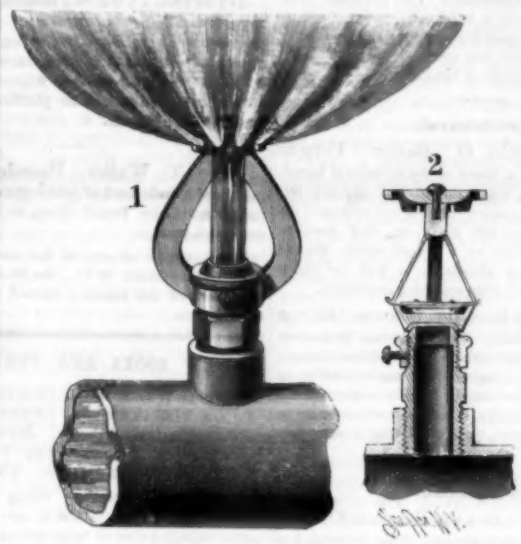
Pulled wool or skin wool is the wool that is pulled off the skins of slaughtered sheep after going through a process of washing, painting and drying. The wools are of different lengths, and are graded into what is called carding, combing, carpet and knitting wools. The fresh skins are gathered up from the slaughter houses as soon as possible and placed into a 6 by 14 wooden soaking tub, where they are left until they become thoroughly soaked with water. They are then taken out and put into a wringing machine. This wringer is tin pail shaped and revolves around inside of a circular iron frame. The wringer is made of iron; it is about 4 feet in diameter and 3 feet in height and revolves around by means of a perpendicular shaft running down through the center. Attached to the side of the framework of the machine is a small steam apparatus which connects itself by means of a crank to a horizontal shaft running across the center. Connected to this shaft is a solid two-foot beveled wheel which rests firmly against a small conical-shaped wheel connected to the center shaft. When the machine is set in motion the revolving of the large wheel which rests against the other causes the center shaft with the wringer to revolve also. About 40 or 50 of the wet skins are put into the wringer at a time, and after revolving around a few moments at the rate of 120 revolutions per minute, which causes the water to leave them, which is carried off through a number of holes at the bottom, they are then taken out and the under or skin side painted with a solution of lime and sulphite of sodium. This coating of paint after lying about 6 or 8 hours acts on the pores of the skin and loosens the hair so that the wool can be easily pulled off. The skins are then taken to the pulling beams and the wool stripped off and sorted. The pulling beams are oval shaped and made of pine. The attendant places one skin at a time on the beam and pulls the wool off by the hands. One man can strip and sort from 80 to 100 skins per day. The wool is then taken to the drying room. The contrivance for drying is about 75 feet in length, about 10 feet in width, and about 5 feet in height, the sides being inclosed with wood with an asbestos flooring. The wool is spread as uniformly as possible over a framework of wire netting fastened securely to the sides, about 4 feet above the flooring. The heat is introduced underneath the wire netting by means of a Sturtevant blower. This blower draws the heat from an inclosed coil of steam pipe and forces it out through a two-foot pipe into the end of the drying box. The heat passes underneath the wire netting and up through the wool, drying about 1,000 pounds in a temperature of 140° in about 3 hours time. The wool is then packed in bags of about 175 pounds each, and is ready for the woolen mills. The pelts or skins, to the number of 500, are then put into wooden vats containing a solution of lime and water. These vats are about 9 feet in depth, about 12 feet in length and about 4 feet in width. The skins are left there about 10 days, the lime taking off the fine hair not pulled off by the hand, and also preparing it for the tanner. They are then washed off with a hose and taken to the fleshing beams, where every particle of flesh and fine hair is scraped off by the operator drawing a double handled knife back and forth over the skin. An expert operator can scrape about 16 dozen per day. The skins are then put into a drench tub holding about 800 gallons of warm water, suspended over which is a paddle wheel 6 feet in length and about 3 feet in diameter, the bottom of which rests in the water about 6 or 8 inches. A quantity of bran is added to the water, the wheel set in motion, which drives the water back and forth through the skins, taking off the dirt and cleaning them for the next operation. After drenching for 6 or 8 hours they are placed in a hydraulic press between iron plates and a pressure of 3,000 pounds to the square inch is put upon them, which forces out every particle of grease. They are then pickled in vitriol and salt and ready for the tanner. The sketches were taken from the wool pulling establishment of James C. Malone & Co., Jersey City, N. J.



MANUFACTURE OF PULLED WOOL.

A FIRE EXTINGUISHING SPRINKLER.

This is a simple device designed to deliver a drenching shower of water from a supply pipe when the heat in a room where it is placed becomes sufficient to melt the fusible metal joints of its peculiar sealing connection, thus releasing the sprinkling mechanism and water seal at the same time. The improvement



HOLMES' AUTOMATIC SPRINKLER.

has been patented by Mr. Thomas Holmes, of Chicago, Ill., P. O. box 655. Fig. 1 shows the operation of the device and Fig. 2 is a sectional view. A cylindrical shell, having one end adapted for threaded engagement with a water supply pipe, is connected at its other end with an oval yoke piece by a ferrule, a set screw securing the yoke at any desired point on the end of the shell. On the outer end of the shell is the seat of a dished sealing cap, a joint piece being introduced, preferably of soft sheet metal. The sealing cap is shaped to receive the tie-plate of a prop piece composed of two similar right angle bent plates whose upright members are soldered with a fusible metal cement, the horizontal members being likewise secured in place with fusible metal solder and two fusible pins, the cap itself being oppositely cut away to form limbs on which the horizontal members of the cap plates bear. At the outer end of the oval yoke are two opposite bearing points which receive the notched lower ends of brace plates whose upper ends engage the lower surface of the horizontal members of the prop plates, while in the flat terminal of the yoke, at its axial center, is a threaded perforation, the exterior of the end being rounded and converged to produce a conical deflector for liquid projected from the shell upon it, or the part may be cylindrically formed. The proportionate size of the parts is such that the sealing cap will normally be held closely pressed upon the joint plate, and water or other liquid in the supply pipe will be prevented from leaking; but, on the temperature being raised sufficiently to melt the fusible joints, the parts which support the sealing cap yield to the water pressure, permitting a strong flow of water, which the spraying disk throws outwardly, breaking up the column into a shower of fine streams.

Japanese Lacquer.

Under the auspices of the Japan Society, a classified loan collection of specimens of Japanese lacquer, illustrating the work of each master and school, was lately opened at the rooms of the Royal Medical and Chirurgical Society, Hanover Square, London. Subsequently, at a meeting, Mr. Ernest Hart read a paper on "Masters, Periods, and Styles in the Lacquer Work of Japan." In this he also spoke of the material, the method of working it, and the localities in which it was produced. It had been well said, he remarked, that of all art industries the treatment of lacquer was the most refined, the most perfect, and the least monotonous. He regretted the peculiar difficulties under which students of this industry labored, owing to the absence of any standard collection of certified and reputable examples, either at the South Kensington Museum or at any other museum in this country. The industrial importance of lacquer work was hardly less than its art value. He knew no reason why the lacquer tree should not be grown in this country. Its sap, which was used as the material of all lacquer work, was a natural essence, having a vast superiority over any varnishes used here. Unlike even copal, which was an artificial mixture of resin, fatty oils, and turpentine, Japanese lacquer was a ready-made product of nature, which, when hardened, was of mirror-like smoothness, unaffected either by acids or hot water, and of great durability, never splitting or cracking.

It was employed in Japan for an infinite variety of uses, even for such objects as acid tanks, ship keels, and photographic tablets, not to speak of the finer uses for coach panels and objects of domestic use. The unique superiority of Japanese lacquer work was due not only to the special merit of the material, but also to the care and skill shown by the Japanese in the manipulation of the material. The art lacquer work of Japan was essentially individual, and we ought not to treat it merely as bric-a-brac, or as an indistinguishable whole. There was as wide a distinction between the ordinary lacquer tray or cabinet of commerce and the exquisite lacs by the great Japanese artists as between a street placard and a canvas of Raphael. Each of the great masters of lacquer had created a style of his own and had founded a school, of which the traditions were kept alive by his successors for centuries. Many important private collections were now to be found in England, duly catalogued and classified, and he hoped that the present example would be followed for the public benefit in the great art museums in the metropolitan and other centers in Great Britain.

An Improved Mounting Adhesive.

One of the helps the amateur photographer has nowadays is the ready prepared supplies which ease his way to the making of pictures. A good mounting paste, free from grit or lumps, and that will keep moist, is one of the necessities in mounting photographs neatly, and a trial of the Higgins photo. mounter convinces us that it possesses these qualities to a high degree. It is said to contain less water than usual, thus preventing prints from warping or cockling as much as when the ordinary starch paste is used. This permits the prints to dry quicker and to be burnished sooner than usual.

RECENTLY PATENTED INVENTIONS.

Engineering.

HYDRAULIC PROPULSION OF VESSELS.—James C. Walker, Waco, Texas. This is an improvement on a former patented invention of the same inventor, for a method of jet propulsion in which the vessel has longitudinal pipes with propellers in them, in connection with a ventilated bilge water well connected by branch pipes with the propeller pipes. The invention provides means for draining the bearings of the jet nozzles and ventilating and draining the ship's hold.

GRATE.—John L. Baker, Baird, Texas. This grate is more especially designed for use with locomotive boilers, and is arranged to conveniently dump part of the burning fuel in one end of the fire box. A number of grate sections are pivoted in the grate frame and connected with an operating bar, while an auxiliary grate frame is pivoted to the main frame at one end, a grate section pivoted in the auxiliary frame being provided with an arm having a pivotal and sliding connection with the operating bar.

Railway Appliances.

CAR COUPLING.—John Q. A. Johnston, Newburyport, Mass. The drawhead of this device is longitudinally channeled on top at the rear and cross grooved on top at the front, while a link having edge-curved side bars and straight cross bars at its ends is pivoted by a coupling bolt in a transverse inclined slot, means being provided to rock and slide the link. The device works automatically to couple cars as they come together, and the uncoupling can be readily and safely effected from the top or side of the cars.

CAR COUPLING.—Jacob W. Holmes, Okobojo, South Dakota. In this coupler two links are employed, and a hook, with which the links are connected, while the drawhead differs but little from the ordinary construction with which the old style link and pin are employed. The arrangement is such that the coupling links and hooks ride practically in close contact, while yet having ample lateral and vertical play, whereby the coupling may be effected upon a curved or straight line of track, or where one car is higher or lower than another. The uncoupling may be readily effected from the sides or top of the car.

CAR BRAKE.—Harry Thompson, Brooklyn, N. Y. This is a quick-acting brake, more especially designed for electric, cable, or other street cars, and adapted to hold the pressure on the wheels without the use of pawl and ratchet mechanism. The brake handle or crank is on the upper end of a screw rod of quick pitch, which slides without turning, but which turns an internally threaded pinion which engages a spur wheel on a shaft, while a chain connects the sliding screw with the brake levers carried by the car. With this improvement the motorman or gripman can apply the brakes and leave them on, with both his hands free.

Electrical.

BATTERY.—Wilbur M. Stine, Athens, Ohio. This battery consists of one or more positive zinc plates in porous cups, one or more negative plates of carbon or reduced copper oxide, and an electrolyte composed of potassium zincate with an excess of potassium hydrate and also potassium bromide. It may be used as a primary battery and when run down be recharged as a storage battery, and then again used as a primary battery, the electrolyte and electrodes rendering the products of chemical action soluble instead of being deposited on plates, excepting the zinc, so that the charging operation renews both the active electrolyte and the depolarizing mediums.

Mechanical.

LATHE TOOL.—Samuel N. Rapp, Toledo, Ohio. This is a simple and durable tool more especially designed to quickly and accurately turn and finish gas keys, cocks, valve plugs, etc. A holder adjustably held in a revoluble body has a seat for the plug and a slot leading to the seat, while a tool holder is held adjustably on the body, and adjustably held on the holder is a facing tool whose cutting edge extends into the slot of the plug holder. A milling tool also secured to the body extends with its cutting edge concentrically to the small end of the seat, while a drill revolving with the body has at its cutting edge a shoulder for facing the top of the shoulder on the plug.

SAW MITERING DEVICE.—James Lumsden, New Rochelle, N. Y. This is an improvement designed for general use by mechanics, to enable one to make square cuts or any desired angular cut, and to take the angle in panel and other work, to make the beveled cut corresponding to the bisection of the angle of the panel. The invention consists of a saw guide frame, arranged on opposite sides of which and pivoted thereto are supporting bars, with which are pivotally connected arms to connect with a block mounted to slide in the guide frame.

TOOL GRINDER.—Isaac H Gilman, Beloit, Wis. This device comprises a special construction of chuck and chuck holder for carrying and holding the tool to be ground to a grinding wheel, the improvement being more especially adapted to accurately grind drills and similar tools to any angle, at the same time giving the desired clearance.

TIRE SETTER.—Isaac Lehman, Ashcroft, Canada. This invention provides a means for readily forming a pit and a platform adapted to receive a tire and wheel to be set, located within the pit in such manner that it may be conveniently and quickly raised and lowered, and whereby also the platform may be locked in raised position with a simple and strong locking device. When the unlocking mechanism is released the platform is carried downward to a lower position in the pit.

PUMP.—Theodore W. Bleach, Kearney, Neb. This is a combined air and water pump, adapted for simultaneous operation by a single actuator, and together discharging into a sealed receptacle, producing air pressure on a body of water in the receptacle, and thus affording power to raise water through a pipe connected to the receptacle and discharge it at an elevated point. The apparatus is inexpensive and has a gravity-controlled pressure equalizer adapting it for a regular discharge of water at a given point, together with an air-cushioned water discharge pipe affording an elevated water supply as needed.

CLOTH PRESSING MACHINE.—Ernst Gessner, Aue, Germany. This invention relates to a formerly patented invention of the same inventor for a machine in which cloth is pressed between a revolving cylinder and bed plates, and the improvement provides means for moving the bed plates to or from the cylinder almost instantaneously. The invention comprises as a main feature a toggle of peculiar construction, whereby two oppositely arranged vertical lever arms are connected with one another, the toggle being operated by a winch handle or hand lever.

Agricultural.

CHURN.—Martin O. Barke, Fergus Falls, Minn. This is a churn of the cylindrical barrel, vertical dasher class, with a novel and superior lid. The lid is cupped on its upper surface, and apertured for the discharge of cream into the churn, such aperture being adapted to be filled by a scraper spoon, the lid and the spoon being adjustable to seal the churn body and prevent cream from splashing outwardly.

CONVERTIBLE BOX OR COOP.—George Bernhard, Dayton, Ohio. This box has permanent sides, ends and bottom, and the top sections form a cover of such character that the box may be used as an ordinary packing case or may be readily converted into a coop for chickens, ducks, or other fowl, or may be employed as a dog house, thus converting a waste box into a useful article.

Miscellaneous.

TREATING GOLD AND SILVER ORE.—Manuel V. Ortega, Mexico, Mexico. This inventor has devised a process for the treatment of gold and silver ores to rapidly and economically amalgamate the precious metals without the use of chloride of sodium or other chloride, as heretofore employed. The process consists in subjecting the ore to the action of a mixture of sulphate of copper and hyposulphite of sodium or calcium, with the proper amount of mercury. With this process it is not necessary to previously roast the ore or inject steam to assist amalgamation, and the apparatus may be of any kind already in use, such as pans, barrels, etc.

BICYCLE STAND.—Fred G. Hurlbut, Fond-du-Lac, Wis. This stand consists of a horizontal bar supported by branch arms from floor posts, there being at intervals on the bar forwardly projecting spring clamps with jaws adapted to receive the handle bar or head of the bicycle. The improvement affords convenient and inexpensive means for holding a number of bicycles in upright position, and so that they may be readily removed.

POST HOLE AUGER.—Alvin De Witt, Elliott, Iowa. This device comprises opposing shovels or curved spring blades connected by their shanks, while a dirt holder is removably and pivotally located between the shovels. The dirt holder is designed to receive and lift out the dirt loosened by the auger.

CARPET STRETCHER.—Simon Livingston, New York City (No. 1670 Third Avenue). This is a cheap, strong and simple device by means of which the carpet may be easily stretched and nicely fitted when in place on the floor. It has a slotted open frame with transverse arch, a slotted bar extending from the arch to the outer cross bar, which has depending teeth, while a hand-operated lever is adapted to engage a T-shaped stretcher bar.

SASH FASTENER.—John Dohnal, New York City. Two hinged spring-pressed bars are, according to this invention, adapted to be secured to the window sash, and arranged to press opposite sides of a guide strip fixed to the window casing. The device is simple and inexpensive, and will securely hold the sash in any desired position without the use of weights, while permitting of conveniently sliding the sash up or down.

DOOR SECURER.—Charles H. Yokey, New Orleans, La. This is an auxiliary fastening for doors opening inwardly, and the device is so made that it may be quickly and easily applied to any door. It consists of a clamping bar pivoted to one side of a support upon the rear of which is pivoted a locking bar, so that when the clamping bar is turned down the locking bar will engage and lock it. The device is preferably combined with a pocket knife, within which it may be contained without interfering with the blades.

MAIL BOX.—Oliver P. Johnston and Calvin M. Gates, Butte, Montana. This box has a nearly cylindrical upper portion with an open top, a chute being arranged in the upper portion and adapted to deliver into the box body, while a sliding hood turning on the cylindrical portion covers the chute. A receiver plate carried by the hood turns beneath the chute when the hood is raised. The construction of the box is inexpensive, provision is made for the easy insertion of matter, and it is impossible to steal anything from the box except by breaking it or by breaking the lock.

DISPLAY ENVELOPE.—Charles J. Billwiller, Brooklyn, N. Y. This envelope is made of one piece of material, the sides folding over the back and ends folding over the sides, while flaps are fastened to the under side of the back. It is more especially designed for inclosing embroideries, laces, trimmings and other goods, and displaying a portion to permit of inspection without removing the entire piece from the envelope.

INK FOUNTAIN.—Otis M. Moore, Hoquiam, Washington. This is a subsidiary or supplementary ink fountain adapted to be placed and used in the ordinary long fountain of any printing press to facilitate chromatic color printing, as in printing show bills in colors in such a way that one color blends with another where the form is printed at one impression. The ordinary long fountain constitutes a holder within which are set the subsidiary fountains having slots and adjustable gates, and inclined bottoms provided with flanges for supporting them.

POCKETBOOK.—Daniel M. Read, New York City. Exteriorly upon this pocketbook is located a box pocket adapted to carrying stamps, cards, etc., in such manner as to be readily accessible, and at the same time be protected from moisture and soiling. The book is so connected with the box pocket that the outer face of the latter is practically flush with the face of the book, but the box is so shaped and placed as not to interfere with the inner pockets of the pocketbook.

DANCING TOY.—Thomas B. Thorndyke, New York City. A dancing platform is, in this toy, supported by two sets of springs, and one or more figures are arranged to keep regular step on the platform by tapping the latter with the fingers. The figures may also be suspended above the platform by a spring connection with a bracket.

John T. Waller, Pasadena, Fla., has registered a trade mark of which the essential feature is the words "Cedar Tree." Used in the orange, lemon and peach trade.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

HOW TO WIRE BUILDINGS: A MANUAL OF THE ART OF INTERIOR WIRING. By Agustus Noll. New York: C. C. Shelley. 1893. Pp. vi, 162. With many illustrations. Price $1.50.

The subject of electrical wiring is here excellently treated. The subject is not a very large one, but the author manages here to bring before the reader salient and interesting points relating to it, giving many excellent suggestions of his own in addition to the supply of examples of the methods in use by electrical constructors. Under theater lighting the two systems which are shown of maintaining foot lights below the level of the stage floor are interesting. The destruction of wires by moisture is an interesting topic treated under the head of electrolysis. Converter work, fuse wires, the distribution of light, and hints to foremen are types of the subjects treated, and illustrate the very practical nature of the book.

AN ELEMENTARY TREATISE ON FOURIER'S SERIES AND SPHERICAL, CYLINDRICAL, AND ELLIPSOIDAL HARMONICS, WITH APPLICATIONS TO PROBLEMS IN MATHEMATICAL PHYSICS. By William Elwood Byerly. Boston: Ginn & Company. 1893. Pp. ix, 287. Price $3.

Those who are fond of the higher mathematics in their applications to concrete problems will here find much to rejoice them. In this work the calculus is applied to actual problems, making the book a treatise on what may be termed the applied calculus. Naturally such a work does not lend itself to review, but to any one who has studied calculus in the past and has become somewhat rusty in it, a work like this will always seem attractive and bring with it the desire that time, seconded by inclination, will enable him to go through it. The absence of an index is not to be regretted in this particular book, as an analytical table of contents fully takes its place.

MARINE BOILER MANAGEMENT AND CONSTRUCTION. Being a treatise on boiler troubles and repairs, corrosion, fuels and heat; on the properties of iron and steel, on boiler mechanics, workshop practices and boiler design. By C. E. Stromeyer. London and New York: Longmans, Green & Co. 1893. Pp. xviii, 343. Price $5.

Marine boilers, owing to government supervision, to the system of awarding premiums for efficiency of naval machinery and to Board of Trade inspection, have become perhaps the leading type of boiler. In them the highest efficiency is looked for, and the highest pressures are employed. This work devoted to their construction may be taken really as a treatise on the best boiler practice and boiler management. Its characteristic is thorough practicability. Everything is treated from the practical as well as the theoretical standpoint, and numerous illustrations cover all the details of construction, even to the proper use of the calking iron, the protection of cracks and weak points, the determination of fractures and other similar points. It is emphatically a work that every boiler maker should have.

EXPERT BOOKKEEPING AND "100 HELPFUL HINTS." By Marcus A. Emmons, expert accountant. Detroit, Mich.: The Bookkeeper Publishing Company. 1893. Pp. 200. Price $3.

To properly review this book one should be an expert. A casual examination, however, makes it very evident that the subject has been thoroughly worked up and put into the most practical shape. The 100 helpful hints are very interesting. A chapter on signatures gives curious examples of bank cashiers' autographs, and is very entertaining.

A LABORATORY GUIDE FOR A TWENTY WEEKS' COURSE IN GENERAL CHEMISTRY. By George Willard Benton. Boston: D. C. Heath & Co. 1893. Pp. 163. Price 40 cents.

This is a high school book, a book for use by young students in chemistry. It is interleaved throughout, carrying out the idea that the student shall make notes of his work on the blank pages. Among the appendices we note references for all of them to Remsen, Shepard, Fresenius, Attfield, and other scientific works, so that if desired, each experiment can be followed up in detail as far as the literature of the subject is concerned. The arrangement which it follows is excellent.

A HAND BOOK ON THE STEAM ENGINE, WITH ESPECIAL REFERENCE TO SMALL AND MEDIUM SIZED ENGINES FOR THE USE OF ENGINE MAKERS, MECHANICAL DRAUGHTSMEN, ENGINEERING STUDENTS, AND USERS OF STEAM POWER. By Herman Haeder. London: Crosby Lockwood & Son. New York: D. Van Nostrand Company. 1893. Pp. vii, 440. Price $3.

This excellent and reasonably complete work bears a distinctly English aspect. The time, however, has come when every American is rather in favor of than against a technical work. Even American locomotive engineers are awaking to the fact that a compound locomotive is not only a practical, but may be a highly advantageous form of structure. So that this profusely illustrated hand book, describing principally English work, may be warmly commended to our engineers.

PALLISER'S MODEL DWELLINGS. By Palliser, Palliser & Co., architects. New York: J. S. Ogilvie. Pp. 95. Price $1.

Plans of numerous low-priced houses, with accompanying text of considerable interest, makes up this publication. The dwellings cover a wide range of cost, and it would seem that those desirous of building country houses would be sure to find in so comprehensive a work something adapted to their needs.

PEOPLES' POCKET STAIR BUILDER AND CARPENTERS' HAND BOOK. By William Peoples. Pittsburg, Pa.: Nicholson. 1892. Pp. xvii, 247. Price $5.

The author states that the object of this book is to supply a manual for the young stair builder, carpenter and joiner, that would be to them what Haswell and Trautwine are to the engineer. The author has worked at the trade of carpentry and stair building for 43 years, so that his exhaustive treatise, for such it is, with its 51 folding plates, should be a *sine qua non* for the intelligent builder.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

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Split Pulleys at Low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Patent Electric Vise. What is claimed, is time saving. No turning of handle to bring jaws to the work, simply one sliding movement. Capital Mach. Tool Co., Auburn, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5714) G. G. D. asks: In the simple electric motor would an H armature do, instead of the Gramme ring, if made the same size? Would the motor run a 12 foot canvas canoe? Which would be the cheapest way to run it, by plunge batteries, or by storage batteries charged with gravity batteries? How long will four cells of storage batteries run the motor until becoming exhausted. A. The H armature is very seldom used now, and will not give you good results in place named. The motor will hardly run your canoe. Storage batteries are much the cheapest. They should have at least one square foot of positive plate, and will run the motor ten hours.

(5715) F. W. D. writes: We have a room 25 feet by 20 feet by 15 feet high with four large windows, all on one of the longest sides. Through the center, longest way, runs a 20 inch belt ten feet from floor and boxed in. At all times during winter, and at most times in summer, the electrical attraction is sufficient to raise the hair and mustache of a person standing within six feet of the belt. It has become a nuisance. Can you suggest a remedy without disturbing the belt? A. You might try covering or lining the box with tin or wire gauze and connecting this to a water pipe by a thick copper band or wire. Possibly if the lower side of the box is thus treated it will stop the trouble. A slight injection of steam into the box would tend to ameliorate the condition, but might injure the belt.

(5716) L. C. G. asks: Will you please tell me how to make a primary battery that will make a 16 candle power light? What kind of a dry battery will make a 2 candle power light? A. For 16 candle power you will need 20 volts and 1·8 amperes. The smallest battery to give this must have 80 cells and be of 11·1 ohms resistance. A plunge battery of 80 couple with plates 6 inches square should answer. For dry batteries address any of our advertisers who deal in electrical supplies. See our SUPPLEMENT, No. 157, 767, 792, and SCIENTIFIC AMERICAN, No. 20, vol. 61, and No. 2, vol. 67, for batteries of classes asked for.

(5717) A. F. K. asks: Is there any virtue in the prism lens in spectacles? A. Prismatic lenses are used in spectacles, often in combination with cylindrical surfaces. Their use is determined by the condition of the eye. We do not find the word you give, in the dictionary.

(5718) J. A. C. asks if a telegraph instrument (relay) wound to 300 ohms would be sufficient resistance to discharge small storage cells through, also if one wound to 8 or 10 ohms would do? A. These questions cannot be adequately answered without a knowledge of the size of the wire and the number of storage cells arranged in series.

(5719) J. E. H. asks: 1. What is the resistance required for a voltmeter measuring potentials varying between 5 and 120 volts? I have figured in the neighborhood of 1235. Is that correct? If right, what size wire is convenient for winding to obtain the desired resistance? A. There is no specific resistance in the case named. The size of wire is determined by its resistance. The resistance must be high enough to prevent heating. 2. An ammeter has been constructed so as to measure currents varying between 10 and 50 amperes, and it is desired, without altering anything but the gauge of wire used, to wind to measure currents varying between 5 and 25 amperes. What should the resistance and gauge of wire be? A. The conditions are not very fully expressed. As we understand it, twice as many turns should be given the coil for the lower currents. The less the resistance, the better. The new wire might be of half the cross sectional area. 3. I would like to make a magnet, the core being 5½ inches long, 4½ inches wide and 2¼ inches thick. What would be the diameter of magnet when wound with 11 pounds of No. 22 single wound wire? Or what would be the thickness of the wire from core to last layer of wire? A. Almost exactly ⅛ inch thickness of wire, giving for magnet a cross section 5½×3¼ inches. 4. I have a one horse power shunt motor which I made myself. How could I attach it to a 500 volt street car circuit? I would like to try the motor if I could connect it up in some manner so I may obtain the desired resistance. We have the Westinghouse alternate circuit here, and I see no other place to try it but on the street car circuit. A. Iron wire makes a good material for resistance. If you make good end connections, electric light carbons will answer; ⅝ carbons have a resistance of about 0·06 ohm per foot. Put in plenty of resistance and gradually reduce it, to avoid the danger of burning your armature. You should properly calculate just what resistance is needed.

(5720) F. T. L. asks: 1. Can an alternating current be used to run a common motor or one especially constructed for that purpose? A. A special motor is required. See our SUPPLEMENT, Nos. 692 and 717. 2. Can an alternating current be used for magnetizing purposes? Would the resulting poles be the same as if a continuous current were sent through the coil about the steel bar? A. It will magnetize with some uncertainty as to strength of magnet produced and utter uncertainty as to polarity. 3. Can a 500 or 600 volt and 10 ampere current be produced? A. A 10 ampere current can be produced by 600 volt potential. There is no such thing as a 600 volt current; volts are not an attribute of currents. 4. Can the position of a ship at sea be determined (by those on board) at any time of day, or must all observations be taken at noon? A. Yes; by equal altitude azimuth observations before and after noon. 5. I have heard three different pronunciations of Yosemite Valley. Will you please give me the correct pronunciation? A. Yosem'-i-te. 6. Are the words news and oats used in the singular or plural? A. News is almost invariably treated as in the singular; oats is plural.

(5721) H. S. L. says: A question was given in an examination of the pupils of the high school: Why are latitudes south colder than corresponding latitudes north? A. The southern hemisphere has a predominance of ocean surface, which retains the solar heat to a much larger extent than the land. The northern hemisphere, having a much larger proportion of land, retains the solar heat at its surface during the day and radiates it at night. The great ice-covered Antarctic continent has also a cooling influence over the southern hemisphere, while the Arctic region has a large area of water into which the warm gulf stream is constantly pouring the warm waters of the equatorial region, thus carrying the mean thermal equator to the north of the terrestrial equator, with a corresponding difference of temperatures in the two hemispheres.

(5722) B. M. asks: Which rail do the cars of a passenger train throw the most strain upon going round a curve, also which rail does the last car of a long freight train throw the most strain upon rounding a curve? A. The pressure of a train against the rails on a curve depends upon the conditions of speed and pull or push of the engine. If a train runs around a curve by its own momentum, the pressure is against the outer rail. If it is pulled around by the engine the pressure is against the inside rail. The last car always, under ordinary speed, presses against the outer rail. The raising of the outer rail partially counteracts the centrifugal tendency of the cars to crowd against the outer rail at the assigned speed for rounding curves.

(5723) V. A. W. writes: 1. In the book entitled "Electric Toy Making," by Sloane, under induction coils, on page 94, it is stated that the secondary coil can be wound by putting a circular piece of cardboard half an inch from the end, winding this section full, shifting the paper up one-half inch, winding this section, and so on for the entire length of the coil. Would it not be better to use vulcanite in place of the cardboard, and leave the vulcanite in? A. Cardboard will answer every purpose. It is only requisite to hold the wire while winding. 2. Is it essential or better to shellac each layer of the secondary coil if the wire is silk-covered? A. It is better to shellac it, or to paraffin it thoroughly. 3. Cannot the secondary coil be separated from the primary coil by a vulcanite tubing? A. Yes. 4. Is the platinum at the contact breaker essential or better? A. The platinum is used to prevent oxidation of the contact points. It should be used.

(5724) F. A. L. asks if there is a solution that will make rope fireproof or partially so, and that will not impair the strength. If there is such a solution that you know, of what is it composed? A. There are several chemicals for fireproofing cordage to an extent that they will not burst into flame by a momentary contact. They may be applied by drawing the rope slowly through a trough containing the warm mixture and drying. Borax 6 pounds, sulphate of magnesia 4 pounds, 6 gallons warm water. Also alum 6 pounds, borax 2 pounds, tungstate of soda 1 pound, dextrine dissolved in soap lye 1 pound, with 8 gallons of water, used as above.

(5725) H. J. P. asks: 1. Is it known how or where the electric current passes along a wire? Does it move on the surface, or among the atoms of metal? A. The most acceptable theory is perhaps that the electric wave front has a path opened for it through the ether by the wire, and hence moves forward without oscillation or ether straining. The impulses are often assumed to be given through the ether surrounding the wire, and to be given at all points along its length. 2. Can there be such a condition as motion without something moves? A. No. 3. How many years will the best luminous paint or preparation act effectively if inclosed in an air-tight glass bulb and exposed to sunlight every day? A. We have no exact data on this point. It preserves its quality for a very long period.

(5726) W. C. W. asks: 1. What per cent of the power of electricity will be lost in transmitting it 10 miles? I mean when generated to run machinery with. A. The loss of power in the transmission of electric energy is great or small as desired. A compromise between extreme sizes of conductors and extreme ranges of voltage is adopted, giving the most economical results as regards capitalization, etc. For a small loss the conductor required may be too large or voltage too high. 2. Say for instance, if a well 40 feet deep will furnish 2,000 gallons water per minute, and this water be piped to a distance of 10 miles, attaining a fall of 140 feet. Will this afford enough power, with a good water wheel, to generate enough electricity, when transmitted back to well 10 miles, to raise the 2,000 gallons per minute to the top, 40 feet? A. Probably yes. 3. What horse power will the 2,000 gallons of water, with the 140 feet fall, distance 10 miles, produce? A. 45 horse power net. 4. What size pipe should be used? A. Twenty-four inches diameter. 5. What size wheel? A. Five foot Pelton wheel. A full plan of ground and more elaborate study would be required before undertaking to erect a plant.

(5727) W. A. M. asks: 1. Will common soft machinery casting do as well for fields of eight light dynamo as the soft gray iron named in SUPPLEMENT, No. 600? A. Yes. 2. Also how are ampere turns calculated, or what is an ampere turn? A. An ampere turn is a current of one ampere passing in one complete turn. Thus a current of ten amperes, carried ten times around a magnet core, represents one hundred ampere turns. Calculations are given in Sloane's "Arithmetic of Electricity," $1 by mail.

(5728) G. B. B. asks: 1. Will a Leclanche battery light an incandescent lamp? If so, how many cells will it require to run a one candle power? A. Five or six Leclanche cells would maintain it for a short time only. 2. How long will a bichromate plunge battery last? Dimensions of a cell being 4 inches high, 2½ inches diameter. A. For a one candle lamp three or four would be required and might last half an hour or an hour.

(5729) J. F. asks: I have one-sixth horse power motor made by the Taylor Battery Company, 39 Dey Street, New York. Will you please tell me if I can change it into a dynamo without much trouble? A. No change is needed, except to vary the winding, if the voltage does not suit. Try rapid rotation, to see what current it gives. Small motors are apt not to be properly proportioned to form good dynamos.

(5730) H. L. W. asks if there is any paint that will stand the solution used in the plunge battery, or where can it be had? A. 4 parts resin, 1 part gutta percha, a little boiled linseed oil. Melt together and apply hot.

(5731) J. H. L. asks how permanent magnets are magnetized. A. *a.* By stroking with another magnet under proper restrictions. The methods are given in works on physics. *b.* By surrounding with a coil of wire and passing a strong current of electricity through it. There are many modifications of both methods.

(5732) V. G. A. asks whether lead can be plated on aluminum. Also please let me know where I can find information regarding same. A. Use

Acetate of lead	0 17 oz.
Acetic acid	0·17 "
Water	1 quart.

Use a weak current and scratch brush during deposition.

(5733) A. E. McC. asks how many layers each of Nos. 14, 16, and 18 double cotton-covered copper magnet wire go to the inch. A. 16, 20 and 25 layers respectively of bare wire laid close.

(5734) A. S.—We know of no manufacturer making automatic-cut outs for windmills, but probably any of the dealers in electrical supplies could have one made to order for you.

(5735) A. S. asks for a liquid which will remove oil and grease from brass, and which is not so inflammable as benzine. A. A weak solution of sal-soda in water at boiling heat is the quickest method of removing oil and grease from brass work. If the oil and grease is dirty, as from the polishing process, the water should boil to clean the brass quickly.

(5736) H. K. asks: 1. In a description of the Edison-Lalande battery, one of the elements is referred to as oxide plates. What is the meaning of that? A. Consolidated or compressed oxide of copper. 2. "Type K" has 300 ampere hours capacity. What is the approximate cost of a cell of this capacity? A. Address any of our advertisers dealing in electrical goods.

(5737) W. J. S., W. S. H., W. P. J. D. and others say: Will you kindly send me a receipt for tanning skins for fur rugs and mats, such as coon, fox, sheep, deer, etc. A. To prepare sheepskins for mats: Make a strong lather with hot water and let it stand till cold, wash the skin in it, carefully squeezing out all the dirt from the wool, wash it in cold water until all the soap is taken out. Dissolve 1 pound each of salt and alum in 2 gallons of hot water, and put the skin into a tub sufficient to cover it, let it soak for twelve hours, and hang it over a pole to drain. When well drained stretch it carefully on a board to dry, and stretch several times while drying. Before it is quite dry, sprinkle on flesh side 1 ounce each of finely pulverized alum and saltpeter, rubbing it in well. Try if the wool be firm on the skin. If not, let it remain a day or two, then rub again with alum, fold the flesh sides together and hang in the shade for two or three days, turning them over each day till quite dry. Scrape the flesh side with a blunt knife and rub it with pumice or rotten stone.

(5738) J. M. D. asks: What is the theory and what has been determined by experiment regarding the practicability of keeping a body submerged at a certain distance below the surface of water, and of raising or lowering it at will, independently of any force except what may be contained within itself, such contained force to be human beings, and to operate by the admission or discharge of water? A. The practicability of floating a hollow body containing air as a counterbalance is a very difficult one. The difference in the density of water at various depths, owing to its almost non-compressibility, that any body just floating under the surface needs but a very small addition to its weight to sink it to the bottom. The operation of adjusting the depth of the body by pumping water into and out of the floating body is a delicate one, and has been a serious drawback to submarine navigation.

Replies to Enquiries.

The following replies relate to enquiries published in the SCIENTIFIC AMERICAN, and to the numbers therein.

(5598) In answers to correspondents No. 5598, you recommend the soaking of a camera film in glycerine mixture, to obviate tendency to curl. The following is quite as effective, and less troublesome: Put a good number of films in a printing frame, and put on the top, making it flatten them well. Then expose frame to strong sunlight, or put in a hot place, until it is as hot as the hand can bear, after cooling still in the frame, the negatives will be found to have very little tendency to curl. Of course, care must be taken that they shall not get too hot.—ALEX. S. GIBSON.

(5598) I would suggest to A. L. W., query No. 5598, that if he would varnish his film negatives, he would have no trouble from curling. This method has been very satisfactory to me.—H. H. W.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

January 16, 1894,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abdominal supporter, E. F. De Lashmutt 512,814
Advertising device, portable, P. E. Bergeman 512,937
Air cooling apparatus, J. Murray 512,987
Air for power purposes, apparatus for heating compressed, R. A. Parke 513,053
Ale drawing device, J. Farmer 512 951
Alkali salts, making, H. S. Blackmore 513,013
Aluminum, manufacturing, W. E. Case 512,801, 512,802
Aluminum compounds, making, W. E. Case 512,803
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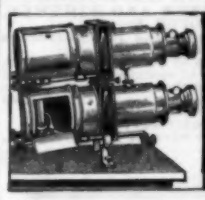

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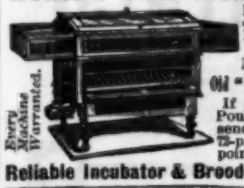

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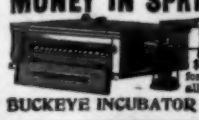

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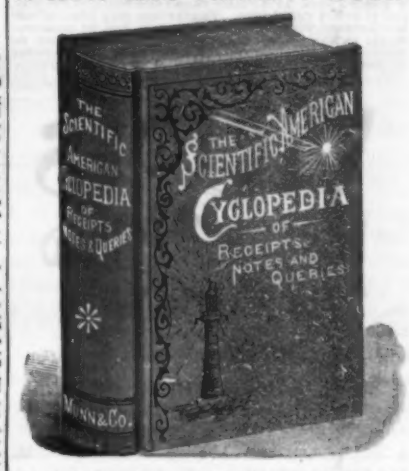

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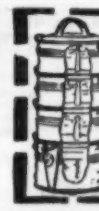

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